American Machinist

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Many of the foremen and assistant foremen at the Ford Motor Company are training school graduates. The group shown at work is winding armatures

Ford Training Courses

H. C. DECKARD

At River Rouge the educational plan includes a trade school and an apprentice school. The former gives boys a trade while the latter enables them, or any employee, to become more expert in their trade

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MANY concerns are discovering that a great amount of our technical and mechanical skill has been lost during the past four years. There are many reasons for this condition. A large number of mechanically trained workers have drifted to other fields; others have lost much of their skill through inactivity. Perhaps the most important reason is the lack of thorough training to rehabilitate the mechanical trades.

The work carried on in this field by the Ford Motor Company is of interest. Training at this plant is carried on by the Henry Ford Trade School and the Ford Apprentice School, two closely allied but separate institutions.

The Ford Apprentice School, formerly the Tool Room Apprentice School, was stated early in 1915. The Henry Ford Trade School was opened one year later for a separate and distinct purpose. The Apprentice School is to provide skilled mechanics and at the same time to give employees a chance for further education. The Henry Ford Trade School was organized to give the needy boy an education and a trade while contributing largely to his own support. There are at present approximately 1,500 students enrolled in the trade school and an additional 2,000 in the apprentice school. At the peak of employment, there were 2,800 in the trade school and 3,500 in the apprentice school. Thirty-five full-time instructors are engaged on academic work alone.

These schools are housed in the River Rouge plant of the Ford Motor Company. Over 500 machine tools of the latest types are set up in the Henry Ford Trade School, which occupies 130,000 sq.ft. or three acres of floor space. The equipment alone is valued at $2,000,000.

Less than twenty years have passed since the apprentice school was started at the Highland Park plant with less than 1,500 sq.ft. of floor space. In addition, a 20-ft. square classroom was available for part time use. I was in charge of this beginning, with one assistant. The equipment consisted of a small planer, a shaper, two drill presses, four lathes, a surface grinder, a universal grinder, a universal and a plain milling machine. It was gratifying to come back after so short a time to see a smooth-working organization carrying on in a way never dreamed of when the system was started with 25 students in 1915.

The reason for this rapid growth is that the school has produced many of the foremen and assistant foremen now employed at the Ford Motor Company. While the large majority of the graduates remain in the employ of Ford, there is no rule requiring service after graduation. Some of the graduates are holding important positions with other concerns.

The Henry Ford Trade School is largely preparatory to the apprentice school. The equipment in the trade school is both for production and for tool and die work. The greater part of the work performed by the apprentice students is on tool making.

Boys receive instruction in all machining operations as exemplified by the elementary grinding illustrated

So many applications to the school are received that the problem is to select the boys most suited to the mechanical trades

Too Many Applications

The school accepts boys from twelve to sixteen years of age; there have been as high as 800 applications for admission in one day, which is the approximate number that can be accommodated in two years. It is impossible to consider applications from other sections of the country, and naturally with a large surplus of applicants, the student is carefully selected.

Upon enrollment the student is given a scholarship. Six dollars per week is awarded each boy, which may increase to as much as $22 weekly by the time he graduates at eighteen. This is a cash award and is paid each two weeks, including class and vacation periods. In addition, the boys are given $2 each month which must be deposited in any reputable bank to develop the habit of saving. This additional cash award must be allowed to accumulate during the entire school period and cannot be withdrawn without aproval. Bank books are submitted for examination monthly; failure to deposit may result in loss of the monthly saving award.

Each student is also furnished with a hot lunch each day served in the dining room of the school. The two cash awards and the meals amount to $375 minimum and $1,225 maximum received anually by the student. The health of the boy is looked after by the factory hospital staff; teeth are examined at regular intervals. When dental work is necessary, the work is performed by the staff dentist at a nominal charge, or the boy may have the work done elsewhere. The academic portion of the course is discontinued during July and August when each student is given a three weeks vacation. The school is also closed for a week at Christmas time.

The training at this school is extremely interesting. Students are divided into three groups and spend alternately two weeks on shop work and one week on academic work. Experience has proved that every third week devoted to academic work, is productive of better results than the same number of hours divided daily between shop and classroom. Students report at 7:30 a.m.; during the week of academic work they are excused at 2:50 p.m. During the two weeks of shop work, however, they remain for a full eight-hour day, five days per week. The subjects are of usual high school grade, stress being put on those which the student will find useful in his daily work. Most of the lessons are taught from sheets prepared by instructors and printed by the school.

Every effort is made to raise the standard of proficiency. A chart is kept from year to year showing graphically the percentage of efficiency, based on careful estimates of the time required by skilled mechanics to produce

the same work. This chart shows also the percentage of spoiled work. Spoilage averages less than 1½ per cent, which compares favorably with the average toolroom. The time consumed has varied greatly over the years since the school was organized. It has risen as high as 60 per cent and dropped as low as 2 per cent over estimated time. The average over the years is approximately 25 per cent over the time required by skilled mechanics.

During 1931, when 966,000 hours of tool work were produced by the school, the over-run on this work was 9 per cent. In 1932 there were 960,000 hours of tool work produced with an over-run of but 3½ per cent. In 1933 over 800,000 hours of tool work were produced with an over-run on time of 4 per cent. The average of all work performed, however, brings the general average much higher than that obtained on tool work.

While English, mathematics, mechanical drawing and shop theory are taught through the entire course, lessons are taken largely from the plant. Blueprints of parts in process in the plant are frequently used in the classroom. Geometry problems are of this type with slight importance attached to the demonstration of theorems as such. In addition, academic work consists of elementary science, chemistry, physics, civics, commercial geography, economics, and auto mechanics. A number of these subjects are given in order that the graduate can secure high school credits if he wishes to attend a regular high school or college at a later date.

While it is possible for the student to complete the course of study in two and a half years, the average is nearer four years. The course is laid out in semesters of 21 weeks; seven of these are devoted to academic work and 14 to shop work.

One of the slogans of the school is, "not to be satisfied with equaling a performance or method;" an effort is made to improve on whatever condition exists. This spirit has resulted in a number of marked improvements. One of these, the piston pin inspection machine, has been described previously (*AM*—Vol. 78, page 463). This machine was designed by one of the instructors of the trade school; it was built in the trade school and is a fine example of the training and encouragement the student receives.

The student body is divided into three groups, in order that the more industrious and brighter student, may not be retarded in completing his training as rapidly as possible. Groups are formed on a basis of the marks received in the previous semester's work which acts as an added incentive to the student.

Classes receive instruction in the fundamentals of projection and mechanical drawing

Layout for sheet metal work helps develop the boys' initiative and familiarity with shop practice

The Mathematics Course

For a summary of work in one subject, we will take mathematics. The complete course ranges from the A class to G class, the letters designating the number of semesters necessary to complete the course. In the starting, or G class, the student is given a review of arithmetic, including the handling of fractions, the conversion of fractions to decimals, proportion, percentage, mensuration and square root. The second semester includes algebra, while in the E class, a general review of simple equations is given, as well as formulas for quadratic equations, simultaneous equations and elimination of terms. As many practical problems as possible are used in this class.

The D class takes up geometry, that is, geometric relationship rather than the proof of theorems, which is continued in class C. Special stress is placed on the circle, particularly those rules dealing with chords, arcs, angles and tangents, preparatory to the work in the B class, which includes the practical application of trigonometry. The work in the A class consists wholly of the solving of problems taken from

actual blueprints. Upon completion of the course in the trade school, the student is graduated into one of the departments of the Ford Motor Company. His progress from this point is largely dependent on his own effort and ability. He may elect to continue his study in the apprentice school if he so desires.

The Apprentice School

The Ford Apprentice School was organized primarily for the training of tool and die makers and still functions largely for this purpose. In addition, however, courses of varying length have been added in drafting, electrical work, brick masonry, wood and metal pattern making, metallography, steam and electrical engineering, and power plant operation. The apprentice school is operated for the benefit of any of the employees of the Ford Motor Company. There is no tuition; but the student attends class on his own time. These classes are so arranged that a minimum of the employee's time is required. The day shift attends class immediately after the day's work is over, which is also true of the midnight shift. The employee of the afternoon shift however attends class at 1:45 p.m. or just prior to reporting for work. This schedule makes it unnecessary for the student to make a special trip for his class work.

While the graduates of the Henry Ford Trade School make up a large portion of the enrollment in the apprentice school, the various courses are open to all employees of the Ford Motor Company. There are no restrictions as to age with the exception of apprentices of no previous experience. It is considered desirable to have these men under 25 years of age. The student in the apprentice school attends class twice a week for a period of one hour. The class work consists of blackboard lecture work by an instructor. The student is then given home work requiring from one to four hours of his time. These lessons are turned in the following class period and graded. If the student falls below 75 he is given the lesson over as many times as necessary for him to attain a passing grade.

There are four principal branches in the apprentice school: mathematics, mechanical drawing, electricity and metallurgy. The mathematics course is laid out to assist the tool and die maker, the pattern maker, draftsman, tinsmith and allied trades. It is divided into twelve sections of eight lessons each.

The overhaul of a universal grinder forms part of the course in machine repair

Starting with ordinary arithmetic and continuing to the practical application of trigonometry, gearing of all kinds, including design of spur, bevel and helical gears and compound gearing. The mechanical drawing course consists of six sections of eight lessons each.

The electrical course is divided into fifteen terms of eight weeks. Before a student is admitted, he must pass an examination in elementary mathematics. If he fails he is placed in a special class to prepare him for future entrance. The electrical course is designed to help those employees interested in becoming skilled electrical workers. Underlying principles of electricity, operating characteristics, methods of constructing and repairing electrical equipment is stressed. The school offers an excellent opportunity in this line as the equipment is continually kept up to date by the addition of the latest electrical appliances. The course is laid out to give the proper balance of practice and theory not obtainable in the ordinary trade or technical school.

Like the course in electricity the course in metallurgy combines the practice and theory necessary to have an available supply of skilled men for various positions in the company's laboratories, heat-treating, iron and steel foundries and the steel mills.

The tool and die apprentice spends his entire eight-hour day in the tool and die room. He is under the supervision of an apprentice foreman and instructor; he also receives instruction from the regular departmental foreman. The apprentice is usually started either on a shaper or a lathe. The minimum amount of time on a shaper is six months and on a lathe eight months. In order to hold the course to a reasonable length of time, no apprentice is given more than two months in excess of the minimum time allotted to any one machine. Should he feel, however, that more training on a particular machine is needed, he is allowed that privilege upon completion of his course.

A minimum of nine months is allowed on various types of milling machines. The apprentice next has a minimum of eight months on all types of grinders which finishes the regular machine training. He is then transferred to the bench. Bench work is divided into approximately three months on repair and a minimum of six months on new work. The course

Courses in radio are included in the curriculum

is laid out to give a good working foundation in the mechanical trades.

During his entire course the apprentice is graded as to ability. Reports are filed in the school office at the conclusion of each machine period, where they become a permanent record. Upon completion of the course, the apprentice is given a graduation card, on which his grades and the amount of time spent on each machine are listed. The average mark received in mathematics and mechanical drawing are also shown. The record in the school office is filed chronologically so that the date of transfer from one machine to another comes up automatically. If impracticable to transfer the apprentice at that time, the notice is returned to the office with notation as to when the transfer should be made.

The results obtained in the Ford schools are ample proof that practical education is much to be desired. This type of training should become more popular and a part of our regular educational system. It more nearly answers the requirements of industry than any system with which I have come into contact.

Factors Influencing Creep

R. W. CARSON
Assistant Editor, Product Engineering

Recent studies show that creep at normal temperature is closely related to high-temperature creep although the controlling factors are different

CREEP under steady loads at normal temperatures often is an unsuspected source of trouble where dimensional accuracies are held to small limits. In calibrated springs such as pressure release valves, clutch and valve springs in automobiles, scale springs, or other elastic members adjusted to a given load-deflection rate; in spring suspensions used to absorb vibrations, in electric motor shafts and long line shafts not in use, or in any machine part subjected to a constant heavy load for long periods of time, creep may be responsible for misalignment, change in force, unbalance or other dimensional changes.

Creep at normal temperatures has many characteristics similar to the high temperature creep found in tubes and drums in boilers and oil-cracking stills. As explained by P. G. McVetty in "Working Stresses for High-Temperature Service," in *Mechanical Engineering*, March 1934, at least four variables influence creep at elevated temperatures: stress, deformation, temperature and time. Two distinct classes of creep problems depend on these variables. In the first type, working stresses are constant, with deformation or creep increasing with time. The second type may be represented by a bolt which holds two flanges together. Original tightening of the nut applies an initial stress, but as creep occurs in the bolt the stress becomes less, and the bolting pressure thus decreases. This is commonly called the "relaxation" problem. These same factors apply in general to creep problems at ordinary temperatures.

May Be Crystalline Effect

Although the exact nature of creep is not known, one hypothesis is advanced by M. F. Sayre in "Plastic Behavior in the Light of Creep and Elastic Recovery Phenomena," in the *Transactions* of the American Society of Mechanical Engineers, Vol. 56, pages 559-561. This explanation indicates that creep at elevated temperatures—and creep at room temperatures as well—is a crystalline effect; that is, creep occurs at isolated points over a given cross-section, not uniformly across the entire section.

The creep effect in a given stressed part, according to this conception, is the sum of the deformations in each crystal. Some of the crystals will be so situated that a relatively small external load will cause creep, while other crystals may be positioned so that only a relatively large stress will result in deformation. Thus, the creep of the entire stressed part will be influenced by conditions existing over a large number of very small portions of the cross-section. Complete readjustment or deformation does not occur suddenly with an application of stress. Purely elastic deformation—that is, the initial deformation that completely dissappears when the load is removed—takes place instantly, but creep proceeds at a slow rate. Sensitive measurements show that creep under a steady load

may continue for weeks or months. This long-time, slow-speed effect is also explained by the hypothesis proposed by Mr. Sayre on the assumption that creep is a crystalline effect.

With the present knowledge of the effect of slip planes and conditions at crystal boundaries this explanation seems entirely satisfactory. It accounts for the effect of increased temperature in hastening creep, as well as the slowly decreasing rate of creep under steady conditions. And the explanation leads directly to the conclusion that creep at room temperature is essentially an extension of high-temperature creep into a lower range of temperatures.

Smaller at Low Temperatures

In high-temperature service, it is well known that creep decreases with lower temperatures. Creep action at room temperature, therefore, is much smaller, and ordinarily does not present as great a hazard as the creep present in high-temperature equipment such as steam boilers and turbines. The effect of increased stress in increasing creep at high temperature is also well recognized. Measurements at normal temperatures show stress has a similar influence, the effect being relatively the same as at elevated temperatures, although the total creep is less. But there are several other factors not present at high temperatures that have a large effect on creep at room temperature. Internal stresses, cold working, heat-treatment and concentrated stresses are of the greatest importance in controlling creep at normal temperatures.

Although the effect of a given stress varies with different materials, internal stress conditions in the normal temperature range is the one factor of greatest importance in materials that are cold worked. But internal stress conditions can not be measured directly. And without a complete history of the mechanical and thermal treatment of a given part it is difficult, if not impossible, to estimate the intensity and distribution of internal stresses. Cold work or plastic deformation invariably alters conditions over some of the minute portions of the cross-section, thus altering the creep effect. In the same way, heat-treatment that sets up thermal stresses has an almost unpredictable effect on creep. Unequal distribution of load stresses—conditions such as those brought to light by photoelastic tests—also influence the rate of creep over various portions of a given cross-section. Since the relative importance of these factors varies with the particular conditions involved in a given part, no single method of control will minimize the effect of all these factors in all applications.

To obtain precision measurements of the effect of cold working and heat-treating, creep effects of less than 0.00001 in. are detected by this electronic micrometer

In determining the proper method for controlling creep, it is necessary to recognize that the rate of creep is greatest at the start, and that it tends to reach a stable condition in time if the load is steady and not too great. Under these conditions the deflection increases at a logarithmic rate as shown in the accompanying chart. In a test of phosphor bronze springs, using the electronic micrometer shown in the accompanying illustration, more than half of the amount of creep found at the end of a month under a steady load took place during the first ten hours of the test.

Creep Is Reversed

After creep has taken place in a stressed part, removal of the load sets up creep action in the reverse direction. This recovery effect progresses in a logarithmic manner, like the creep action, but the rate is much slower. Usually, complete recovery will require ten hours of rest for every hour under load, and even then the total amount of recovery ordinarily is less than the creep. If another creep action is introduced before complete recovery has taken place, both effects continue to influence deflections. When several successive creep and recovery effects are superimposed, the total change in deflection becomes unpredictable. In fact, the effect of creep can be masked for a short time by repeated stressing; with sufficient rest, however, creep effect again appears.

Depending on the load conditions, the effect of creep can be reduced permanently by two different methods. When parts are subjected to a constant steady load, as in clutch springs or flange bolts, the expected amount of creep can be estimated and an allowance made for the effect. The part then can be aged or allowed to rest under load until most of the creep takes place, after which there will be little appreciable increase. Unless working stresses are too high, this method is reliable and can easily be carried through if sufficient time is available.

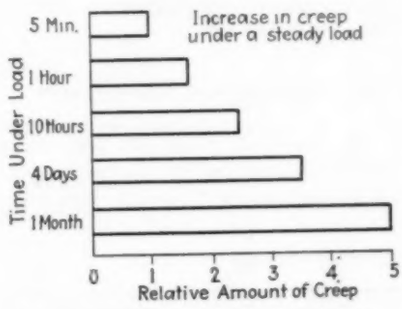
Instead of aging at normal temperature under load, the creep can be hastened by low temperature heat-treatment while the load is applied. As explained before, this increase in temperature speeds up the creep rate, bringing about a stable condition in a much shorter time. However, if the load is removed for only an instant, recovery will start, and it will be necessary to go through the stabilizing treatment again.

This metbod of minimizing creep is of little value when the load causing the creep is not steady, for each time the load changes, new creep action—starting from the instant of load change—is added to the creep or recovery already occurring. This condition of changing load is characteristic of springs in scales and electrical instruments, and also in diaphragms and bourdon tubes. Under this load condi-

tion, the inherent tendency to creep must be reduced, or a material must be selected having a slower creep rate.

The second method of eliminating the effect of creep applies particularly to cold-worked material such as cold-rolled steel, hard phosphor bronze, brass and music wire. Since internal stresses set up in cold working the material greatly increases the tendency to creep the best method of control is the use of a stress relief heat treatment. For springs or other elastic members made from cold-worked metals a stress relief anneal, therefore, is the first step to be used in reducing creep. In fact, such heat-treatment is essential for these cold-worked materials and may account for as much as a 90 per cent reduction in creep. Since the intensity of internal stresses cannot be measured directly, any machine part in which creep is undesirable should be given a stress relief anneal as the first step in reducing creep.

High working stresses or high stress concentrations also are common sources of creep effect. Tests show that the tendency to creep increases greatly for only a small increase in working load. Even at low working stresses, if the stress is doubled the creep will be approximately three times as great. As stresses are increased to the elastic limit, creep action increases rapidly and may eventually result in failure. Therefore, if heat-treatment alone is not sufficient to reduce creep to required limits under steady load conditions, it may be necessary to reduce working stresses to a lower value than would be needed for strength alone.



Creep under constant load proceeds at a decreasing rate, but continues for days or months at higher stresses

Cooling to Reduce Creep

In parts that are moderately heated, it may be desirable to provide better ventilation, more effective insulation or some means of cooling to reduce creep, since even small decreases in working temperature result in decreased creep. In die-casting machines, molding presses, or stressed parts in furnaces, any decrease in temperature will reduce creep action. Like the effect of stress, only a small decrease in temperature results in a much larger decrease in creep, and only a small reduction in the operating temperature of a part through better cooling may result in a comparatively large decrease in creep.

Although other conditions than creep ordinarily control the selection of the material for a given part, it may be necessary to select one having low creep tendency if heat-treatment, reduced working stresses and lower temperatures do not reduce creep to the required minimum.

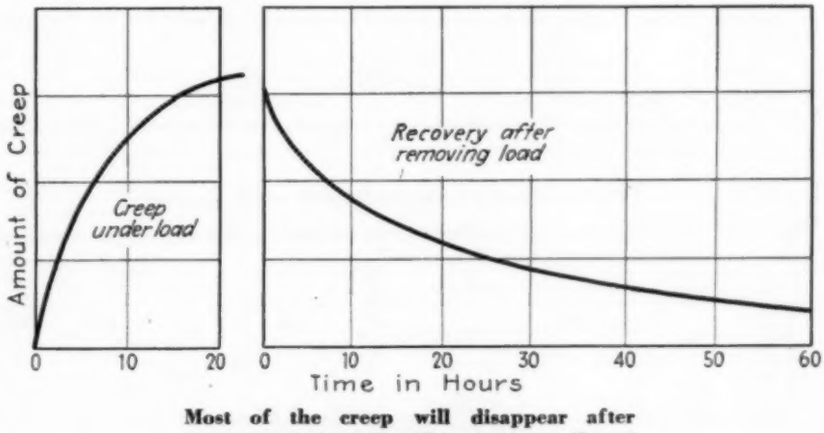
Creep rate varies considerably with different materials. In cold-worked materials the creep, tendency at normal temperature is less for metals having higher annealing temperatures. Copper alloys, including brass and bronze have more creep than nickel or monel metal, while carbon steel and various steel alloys have less creep tendency than any of the cold-worked non-ferrous alloys.

Important exceptions to this generalization are the age-hardening alloys. For some reason, the crystalline conditions accompanying precipitation hardening are highly resistant to creep. Beryllium copper, one of the new age-hardening copper alloys resists creep to a greater degree than hardened steel under similar load and temperature conditions. In addition, this alloy in the fully heat-treated condition has the hardness and strength of alloy steel, and like steel, it can be shaped or formed in the soft condition and then hardened by heat-treatment. Several other copper alloys of the precipitation-hardening type also have low creep tendency. For any part required to have low creep the use of these new alloys should be considered.

In addition to the heat-treatable copper alloys, there are several nickel base materials such as nickel beryllium and nickel steel in which precipitation hardening results in less creep.

A Possible Solution

In using these newer alloys for their increased resistance to creep, not all problems in connection with their heat-treatment, fatigue strength, and fabrication have been solved. Although several of these alloys will safety carry working stresses used with alloy steel, the elastic modulus or stiffness is much less than for steel materials. However, the smaller creep tendency of precipitation hardening alloys may offer a solution to difficult creep problems when heat treatment, reduced stresses and lower temperatures alone do not eliminate undesirable creep.



Most of the creep will disappear after removing the load if sufficient time is allowed

Needles for Scriber Points—Discussion

ELMER OLSON

In an article under the title given above (*AM*—Vol. 79, page 51), Charles Weslow tells how he used sewing needles for scriber points, holding them in a pin chuck.

Although I have never used sewing needles for that purpose, I have been using phonograph needles and will say that they are comparable to the best scriber points, being hard, polished and sharp, and surely nothing could be cheaper.

My holder is a safety-razor handle having a short piece of $\frac{3}{16}$-in. welding rod inserted and drilled a snug fit for the needle and ground to a taper for about $\frac{1}{2}$ in. back from the needle.

Machining Time on Four Railroad Shop Jobs

FRANK C. HUDSON

MACHINES, methods and results vary widely in railroad shops. The types of locomotives to be kept in repair, the amount of work to be done and the financial condition of the railroad all play their part. Nor should we overlook the type of men who control the management policies of the road. There are outstanding examples of forward looking officials who realize that securing efficient satisfactory transportation, and selling it, is the chief business of railroads. Roads managed by these men have the most efficient shops and the best machine equipment and secure the lowest cost in maintaining motive power and rolling stock.

In order to show the progress being made by railway shops we have made a study of the methods employed in performing four every-day, back shop operations. These are operations on crown brasses, cylinders and valve cages, floating bushings for connecting rods, and shoes and wedges. These studies have been made with the cooperation of some of the leading railroads, who prefer to remain nameless. The greatest uniformity is in the use of high speed steel for cutting tools, carbon tools having practically disappeared, at least in the shop practice included in this article.

While only one example of tungsten-carbide tools appears in the tables, the tendency toward higher cutting speeds is noticeable. Cutting speeds vary widely, depending largely on the operation and the metal. In Table I, crown brasses are turned at from 60 to 190 f.p.m., while in Table III, turning speeds for floating bushings range from 75 to 188 f.p.m. with H.S. tools, and up to 300 f.p.m. with T.C. as a cutting tip.

Crown Brasses

Feeds vary through a wide range, depending largely on the method used. In Table I, for example, we find a turning feed of 0.015 in. with a T.C. turning job and ⅛ in. on a lathe cut crown brass. The machining times for the piece, however, are not so far apart as might be expected.

Examples 2 and 3, Table I, are of interest. No. 2 cuts at 138 f.p.m., takes 13 min. to load on the machine and only 18 min. to machine, if the data given is correct. No. 3 cuts at 159 f.p.m., takes only 5 min. to load but has a total time of 55 min. against 31 for No. 2. Feeds and depth of cut are the same. Example 5, is a bit disconcerting. With a cutting speed of only 60 f.p.m., it uses a feed of ⅛ in., and gives a total time of 33 to 35 min., depending on the skill of the operator. This is considerably less than example No. 3 with the highest cutting speed of all the H.S. tools given.

The difference in setting-up time is very noticeable, varying from 3 to 15 min. Part of this variation is probably due to different interpretations of "set-up" and "loading." In No. 1, for example, it may take 15 min. to set up the crown brass fixture but can hardly take as long as that to load it. The "time per piece" probably includes loading time. Considered on this basis, the times shown give a somewhat different story. In Nos. 1 and 6 the time given includes pressing the crown brass into the driving box as well as machining it.

In the four cases which give the annual requirements for crown brasses, Nos. 1, 2, 6 and 8, a comparison of the total time spent on this job is of interest. Roughly, this gives 2,150 hr. for No. 1, 770 hr. for No. 2, and 725 hr. for No. 8. On the basis of 1,000 each, Nos. 1 and 6 would take 1,000 hr., No. 2 and No. 8, 500 hr. each, or about half the time.

Cylinders and Valve Gages

As shown in Table II the use of liners in cylinders has become almost universal. New cylinders and valve

Table I—Crown Brasses

Machine Used	How Held	Tool	Cutting Speed f.p.m.	Feed in.	Depth of Cut in.	Set-up Time min.	Time per Piece min.	No. per Year
1. Shaper	Special Chuck	H.S.	20	⅛	1/16–¼	15	60	2150
2. Boring mill	Fixture	H.S.	138	0.083	⅛	13	18	1536
3. Boring mill	Chuck	H.S.	159	0.083	⅛–¼	5	50	....
4. Boring mill	Chuck	H.S.	85	1/16	⅛	3	..	.....
5. Lathe-Shaper	Mandrel V-block	H.S.	60	⅛	⅛–¼	3-5	30	.....
6. Shaper	Special Chuck	H.S.	...	.....	¼	15	60	2160
7. Boring mill	Fixture	H.S. boring	90	1/16	⅛–¼	..	..	....
		T.C. turning	190	0.015	1/16–⅛	..	..	.....
8. Boring mill and slotter	Fixture	H.S.	...	.....	....	5	25	1450

Note: These times given are not easily compared as some as in Nos. 1 and 6 include the pressing of the brass into the box.

Table II—Cylinders and Valve Cages

Are Liners Used? New	Repair	Reboring	How Driven	Speed f.p.m.	Feed in.	Tools	Wear Allowed Cyls. in.	Valves in.	Set-up Time min.
1. None	...	Portable bar	Motor	25–35	1/16–⅛	H.S.	1/16–⅛		40–50
2. Yes	Yes	" "	Belt from motor	30	⅛	H.S.	1/16–⅛		35–50
3. No	Yes	" "	Motor	.....	.....	H.S.	1/16–⅛		60
4. Yes	Yes	" "	Air Motor	.....	⅛ per rev.	H.S.	⅛–¼		30
5. Yes	Yes	" "	Elec. Motor	.....	¼ finish	H.S.	⅛–1/16		60
6. Yes	Yes	" "	Air Motor	.....	.....	.....	.....		.....
7. Yes	Yes	" "	Air Motor	95–110	0.018	H.S.	1/16–⅛		.....
8. Yes	Yes	" "	Elec. Motor	.....	.....	H.S.	1/16–⅛		90

chambers are all bored in standard boring machines but portable bars are used in reboring both the cylinders themselves, and the liners for cylinders and valves. Air motors still furnish the power in most cases, either through belting or gearing. Electric motors are used to drive the bars in Nos. 5 and 8.

Wear allowance is usually held to $\frac{1}{16}$ and $\frac{3}{32}$ in. in cylinders and half of this, or less, in the case of valve cages. One notable exception is shown in No. 4, which gives ½ in. as allowance for cylinder wear and ⅛ in. for valve cages. This road, incidentally, has the shortest set-up time given. Valve cages are evidently watched closely for wear, $\frac{3}{32}$ in. being the wear limit in five of the eight cases.

Cutting speeds vary from 25 to 110 ft. per min., using H.S. tools in every case. Feeds range from $\frac{3}{32}$ to ¼ in. per rev., the latter being for finishing cuts. It will be noted that in No. 7, with the high cutting speed, the feed is very fine, only 0.018 in. per rev.

Figures as to actual working time were given on such varying conditions as to make comparison difficult and misleading. The times given vary from 3½ hr. to 8 or 10 hr., but do not specify just what is included. From 5 to 8 hr. floor-to-floor time, for both cylinders and valves seems to represent the average. The variation in set-up time from 30 to 90 min. is great enough to warrant a study of the equipment used. The difference of an hour between minimum and maximum, is worth careful consideration in any shop. Convenience in location and methods of handling may account for part of the discrepancies.

Floating Bushings

Boring mills seem to be universally used in the boring and turning of floating bushings, as can be seen in Table III. Details of drilling are not available but as only one road reported the use of special fixtures and one drill with more than one spindle, the drilling of oil holes is apparently a hit-or-miss operation in most shops. Here again H.S. tools are universal with the one exception where T.C. tools are used. Cutting speeds vary from 75 to 188 f.p.m. for H.S. tools while 250 to 300 is given for T.C. Feeds vary widely from 0.014 to 0.25 in. The H.S. tool in No. 2 with 105 ft. cutting speed and a feed of 0.047 in. is removing metal faster than the T.C. tool in No. 7, because of the difference in feed per revolution.

Set-up time varies less than in some of the previous operations, although in percentage the variation is over 50 to 100 per cent, depending on whether we take 2 min. or 5 min. as the base. It is interesting to note that the road requiring the largest number, 300 bushings per month, keeps machines set up for the job. This road uses fixtures which enable men to secure uniformity and make the job easier. The machining time is also one of the lowest given in the list. The times given are remarkably uniform for this work.

Shoes and Wedges

The greatest variety in methods occurs in Table IV, on shoes and wedges. Not only the methods and machines used vary, but the materials used. Gray iron, gun iron, forged steel and various mixtures of brass and bronze make up the list of materials. The planer predominates as the machine used, one being of the crank driven variety. Milling machines, both of the planer type and of the manufacturing type, are found in the list. H.S. tools are used in every case.

Holding fixtures of some kind are universal, with the possible exception of the crank planer, No. 5. The air operated fixture in No. 1 permits quick and easy loading and clamping. This is probably an indexing fixture. Fixtures vary in size, holding from 2 to 19, while a second row of fixtures doubles this capacity. The difference in time between milling and planing is very noticeable.

Here again the set-up and loading time varies rather widely, as does the time per piece for machining. Data as to the time required per piece, was given in only three cases.

The set-up time in No. 1 indicates that the milling machine is used on a variety of work and that time given evidently includes the complete teardown of the old set-up and the replacement of the special air fixture used. While the time seems longer than necessary, the machining time per piece is ample reason for the use of the method.

Table III—Floating Bushings

Machine Used	Tool	Cutting Speed f.p.m.	Feed in.	Depth of Cut in.	Set-up Time min.	Times Each hr.	No. per Year
1. Boring mill.....	H.S.	77	0.033–0.066	$\frac{1}{16}$–$\frac{1}{4}$	5	1½	1200
2. Boring mill.....	H.S.	105	0.047	$\frac{1}{4}$	5	1	960
3. Boring mill.....	H.S.	125	$\frac{1}{16}$	$\frac{1}{4}$	3	...	....
4. Boring mill.....	H.S.	188	0.033	$\frac{1}{4}$	5	½	....
5. Boring mill.....	H.S.	75	$\frac{1}{16}$	$\frac{1}{4}$	2	½–¾	....
6. Boring mill.....	H.S.	...	$\frac{1}{16}$–$\frac{1}{8}$	¼–½	5	1	....
7. Boring mill.....	T.C.	250–300	0.014	$\frac{1}{16}$–$\frac{1}{8}$	...	...	....
8. Boring mill.....	H.S.	...	.....	.....	5	¼	3600

Table IV—Shoes and Wedges

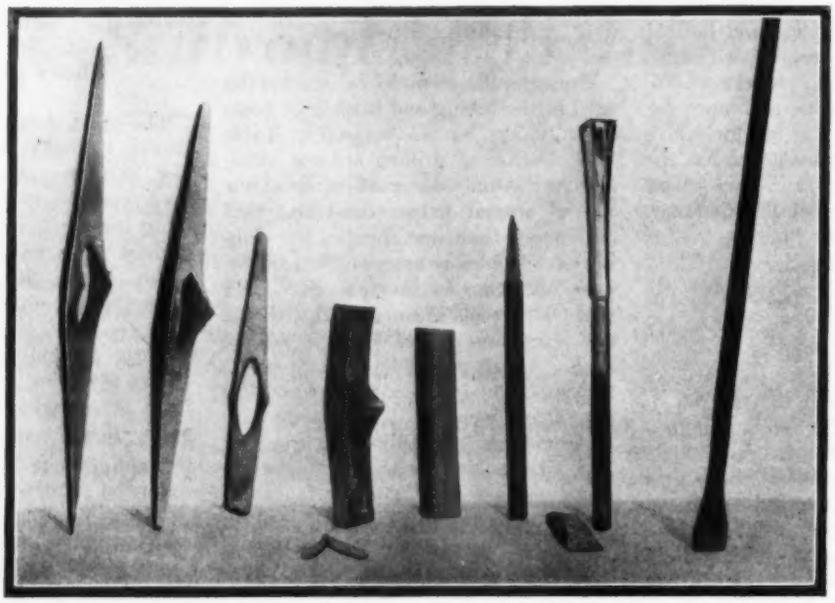
Material	Machine Used	Fixtures Used	Cutters	Cutting Speed f.p.m.	Depth of Cut in.	Feed in.	Set-up Time hr.	Loading Time hr.	No. Required per Year	Time per Piece min.
1. Gray iron & brass	Milling	Air	H.S.	..	¼	4½ to 5	2½	..	1905 iron 152 brass	6–8
2. Brass casting 3½x8x23"	Planer 54x54x36' two heads	2 of 19 ea.	H.S.	14	$\frac{1}{16}$	$\frac{1}{16}$	1	2	1020	30
3. Cast iron & brass	Planer	Holds 9 wedges 8 shoes	H.S.	16	¼–½	$\frac{1}{16}$	1½	2½	.....	24
4. Gun iron	Miller	16 up	H.S.	60	..	..	¼	..	.....	..
5. Bronze	Crank Planer	1	H.S.	50	..	..	2 min.	..	.....	..
*6. Cast iron	Miller	6 up	H.S.	40	¼	..	20 min.	..	.....	13
	Planer	.....	....	..	..	..	..	..	.....	48
7. Steel	Planer	6 up	H.S.	40	¼	$\frac{1}{16}$	20 min.	..	.....	..
8. Cast iron and brass	Slab Miller	2 up	H.S.	..	¼	3½	¼	..	.....	..
9. Cast iron	Planer	4 to 8	H.S.	60	¼–$\frac{1}{16}$	$\frac{1}{16}$	..	20 min.	3600	..
10. Bronze & steel	Planer	16–30	H.S.	..	..	..	..	..	.....	..

*Forged steel wedges, used on newer locomotives, are milled in 40 minutes each.

Fiber Screw Machine Cams

Cutting screw machine cams has always been a sort of trick job for the toolmaker who could wangle the milling machine into following all sorts of contours. For long runs, or standard work, the cam maker's job is still safe. But for comparatively short runs the use of fiber cams is having an inning—Spauldite in this particular case. The cam is laid out on a sheet of fiber, the outline cut with a bandsaw and the contour finished by grinding.

Forging of Hand Tools



J. B. NEALEY
American Gas Association

Furnace equipment, methods and dies are described for manufacturing drills, picks and other tools for railway, mine and marine service

FORGING of hand tools calls for workmanship of high order, steels of good quality and furnaces of efficient design; correct atmospheric conditions within the furnace, are imperative. The Leetonia Tool Company manufactures a complete line of hand tools for the marine trade, railroad picks, mattocks and hand mining tools, including drills, augers and picks. Forging furnaces are conspicuous throughout its several shops, and some of these are of unique design. Gas is the standard fuel throughout the entire plant.

One design, of which there are several units, is a portable slot type forge with a recuperator on top. It is provided with small wheels so it can be rolled about the plant. The smaller of these furnaces is 2½ ft. long, 18 in. wide, 2 ft. high, and rests on a truck. A motor-operated air blower is located on the truck between the furnace legs. The recuperator, or air preheater, is a welded steel box 2 ft. long, 18 in. wide and 6 in. high. Welded into this box are twelve ½-in. pipes forming air passages through it. A hood extends out from one end of this recuperator over the front of the furnace, and air from a perforated pipe, just below the under lip of the furnace slot, is used to force the waste heat escaping from the slot up into the hood and through the air passages in the recuperator.

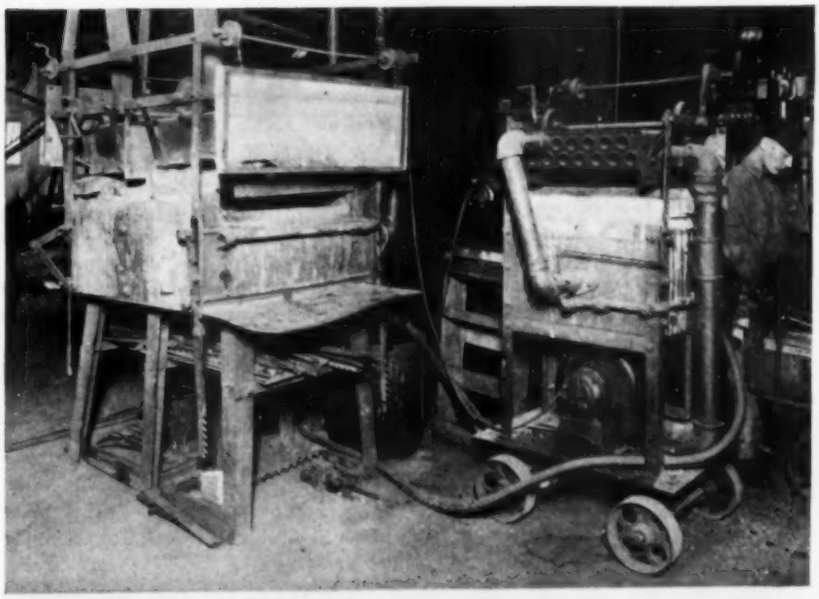
Fresh air from the blower, forced through the box, is warmed by heat transferred through the pipes and then delivered for combustion to the single gas burner. This burner is located in the back wall of the furnace and underfires the work. Gas is delivered at 6 oz. pressure and air at 8 oz. A double unit consisting of two furnaces, identical to the one described except that the unit is stationary and not portable, is located close by. These are used for general forgings.

The different forge furnaces in the plant serve power-driven trip hammers with multi-impression dies. Heavy crowbars and pinch bars are forged from stock containing 0.85 to 0.90 per cent carbon and 0.30 to 0.40 per cent manganese. This steel is heated in a gas-fired furnace 2 ft. square by 8 ft. long. Heat is supplied by two gas burners located in one side overfiring the work. Air for combustion is supplied to the burners direct from the plant air supply (compressor), and the work is introduced through a slot in one end of the furnace. These tools are forged in a five-impression die and then finished in another department. The largest pieces are 4 ft. long, 1½ in. square and weigh 30 lb. They are heated for three-quarters of their length for tapering the handle, and then heated to forge the working end.

Augers for the mines are made in sizes up to 12 ft. long and 1½x1 7/9 in. in cross-section. The stock is heated, and then twisted in a furnace 18 ft. long, 2½ ft. square set on 3 ft. legs. It is heated with ten gas burn-

ers, five on each side, staggered so as not to fire into each other. They are of the nozzle-mixing type, and a single U-shaped manifold furnishes air from a blower. This is paralleled with a U-shaped gas manifold. The work is put in through an opening in one end; when up to heat the stock is put in a twisting machine, chucked at both ends, and one end is turned so as to give it the proper twist. The twists are gaged by eye, and as fast as these develop to the correct point, cold water is played on them to check their further development. The ends are then reheated in a small furnace and formed under tip hammers. To make what is known as a breast auger, the other end of the rod is now heated, split with a hot saw, and the split opened up. The bit stock is ¾x1¼x3 in. long and wedge shaped to fit into this split. The bit and the rod end are now heated to forging temperature 1600 — 1800 F., withdrawn long enough to apply the flux and then heated to 2000 F. They are then withdrawn, put together and welded with blows from a trip hammer. The hammer is equipped with a two-impression die.

A combination drill and tamping rod is made by welding a cutting bit on one end as just described and casting a copper head on the other end. The shanks of these rods are ¾ in. round, 1 to 6 ft. long, and after heating one end, it is tapered and grooved in a two-impression die. It is then reheated to 1,400 F., treated with borax and dipped in zinc in preparation for the casting. Copper is melted in a gas-fired, crucible type furnace with trunnions by which it is suspended in a frame and can be tipped for pouring. Heat is supplied by a single gas burner. The shanks of



Top—At the right is one of the smaller portable slot-type forging furnaces with recuperator above and blower below; at the left is a larger stationary furnace

Center—In forming tools under a multi-impression die the operator is aided by having the heating unit moved conveniently near

Left — Augers are reheated for hardening in a special furnace, 13 ft. long, fired by two rows of burners

the tamping rods are placed in a series of pipes, extending below the floor line, with the hot ends uppermost. Cast iron molds are put around these hot ends and the molten copper poured in.

Many of these tools are hardened in the heat-treating division close by. For this there is a casting alloy lead pot 5 in. x 6 in. x 4 ft. long which is set in a furnace heated with two gas burners. There is considerable variety of work and temperatures range from 1,350 to 1,650 F. After quenching in oil, tools are drawn in nitrate baths contained in four pots which set in a single furnace 2½x3x7 ft. long, fired with four gas burners, one under each pot; temperatures here range from 450 to 600 F. Steel baskets swung from an overhead monorail hoist are submerged in the quenching bath and are employed to catch the work and transfer it to the draw furnaces. There are a number of small muffle type furnaces for heat-treating high-speed tool steel and dies.

Picks are made from high carbon, high manganese, open hearth steel throughout, including both shank and tip. In this division there are six gas-fired furnaces of the slot type. Five of these are underfired with from one to two gas burners each, located in the back wall. They are provided with recuperators and gas and air pressures at the burners are 6 and 8 oz. respectively.

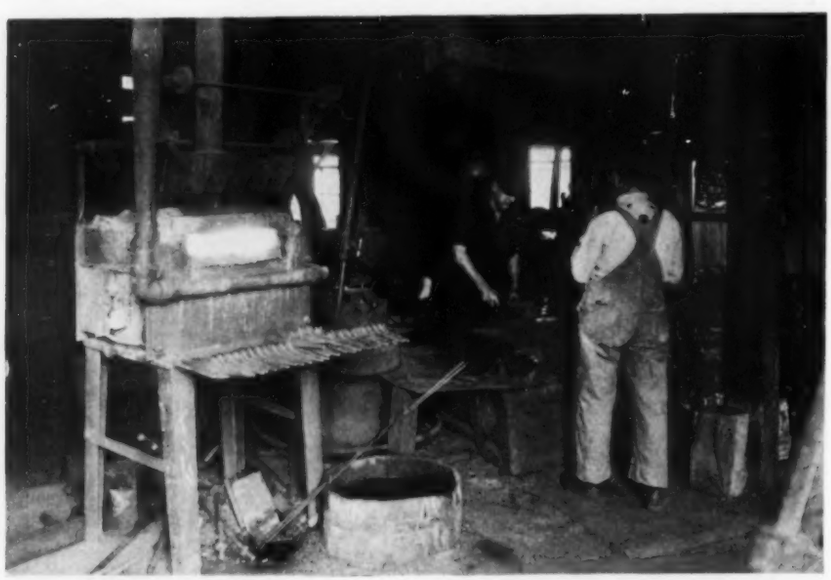
The sixth furnace represents an entirely new design in that combustion from a diffusion type gas burner takes place in a chamber separate from the heating chamber of the furnace. Furthermore heat transfer by convection (in addition to that from radiation) is augmented by controlling the velocity and path of the hot products of combustion. This furnace is 4 ft. square and 2 ft. high. The combustion chamber, located in the rear, is 9 in. wide and 30 in. high which causes it to protrude about a foot below the furnace bottom. The burner fires straight up into the chamber from the bottom.

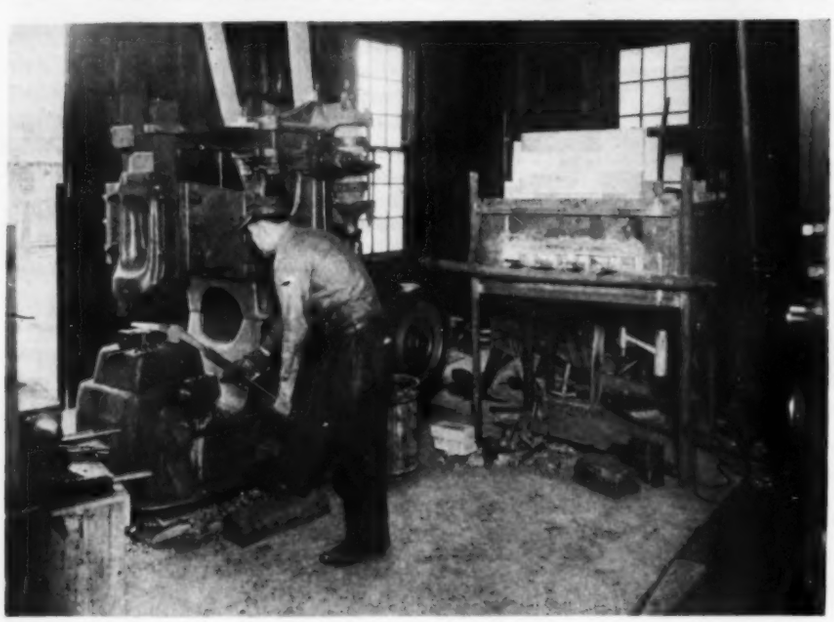
The dividing wall between this and the heating chamber acts as a bridge wall. The opening between it and the roof arch of the furnace is narrowed down to 4 or 6 in. in order to promote combustion and to increase the velocity of hot products of combustion. These follow the roof arch to the front wall of the furnace which deflects them down on the work. This front wall is double with a flue between; the waste heat flowing out through the slot, is sucked up into this flue and exhausted to the atmosphere. This type of furnace, it is claimed, uses 40 per cent less gas than does the ordinary direct-fired furnace with a premix burner, in heating an equivalent amount of work.

The pick stock is 6 to 10 in. long and 1x1½ in. to 1½ in. square in cross-section. The picks are made as follows:

1. Heat in furnace.
2. Form eye-pierce, spread and finish in drop hammer with two impression die.
3. Push plug from eye and trim in trimming die.
4. Rough forge one end.
5. Reheat and rough forge other end.
6. Reheat all over.
7. Finish forge both ends and finish eye—one hammer—open die.
8. Reheat points and sharpen in trip hammer.

All the power in this plant is generated on the premises by two gas engines—a 50-hp. gas engine operating a 40 kv.-a. generator and a 115 hp. unit driving a 75 kv.-a. generator.





Top—A slot type underfired forge furnace is employed for heating picks; note the saw tooth recuperator above

Bottom—At the right is a new design forge furnace in which combustion takes place in a chamber entirely separate from the heating chamber of the furnace

Leipzig's Great Machinery Market

K. H. CONDIT
Editor, American Machinist

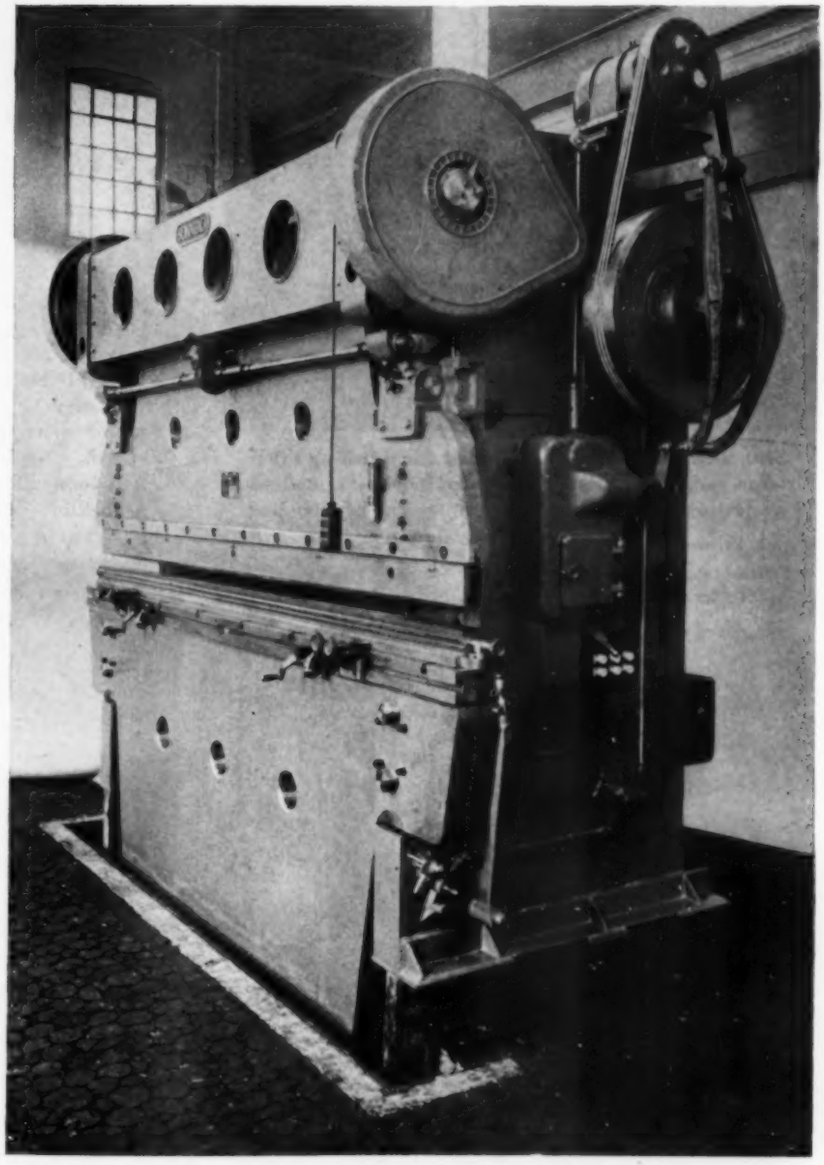
A huge machine tool exhibit forms merely a fraction of this famous German trade fair

LEIPZIG, GERMANY—In the United States we have impressive machine tool exhibitions, railroad shows, road builders' equipment displays, welding and heat-treating expositions and many others, but we have never put all of them on at once. That, in short, is what the technical section of the Leipzig Spring Fair includes.

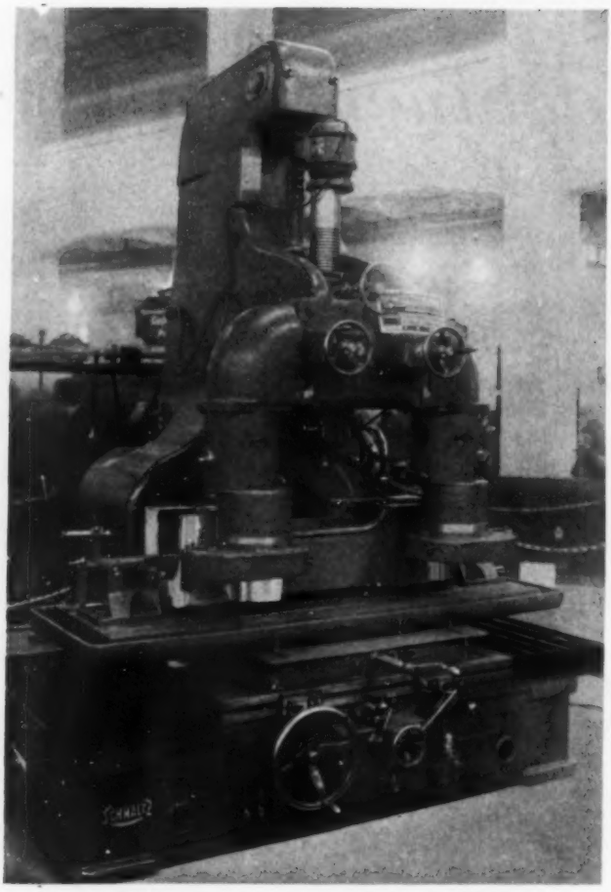
Add to this huge technical exposition filling twenty-odd permanent buildings, and various outdoor spaces, the merchandise or sample fair, held elsewhere in the city, and which is even larger, and you have a show that is unique. To handle the crowds of exhibitors and visitors, Leipzig boasts one of the largest railroad stations in the world and a remarkable system of eating establishments. The wine restaurant in the railroad station is reputed to be the best place to eat during the fair. Together with the other restaurants in the station it will accommodate 5,000 diners at one sitting. On the second day of the 1935 fair 33,000 meals were served.

As Leipzig is normally a rather humdrum city its 3,600 hotel rooms are more than ample for ordinary needs. During the fairs they are supplemented by 40,000 rooms in private homes and apartments throughout the city. The polyglot horde that descends on the fair naturally brings with it certain very real problems arising from differences in national customs. At the extremes are the Americans and British who want daily baths and some Eastern Europeans who never saw a bathroom. The latter group has less to contend with. No American should think of going without careful advance arrangements made through the New York office of the Leipzig Trade Fair.

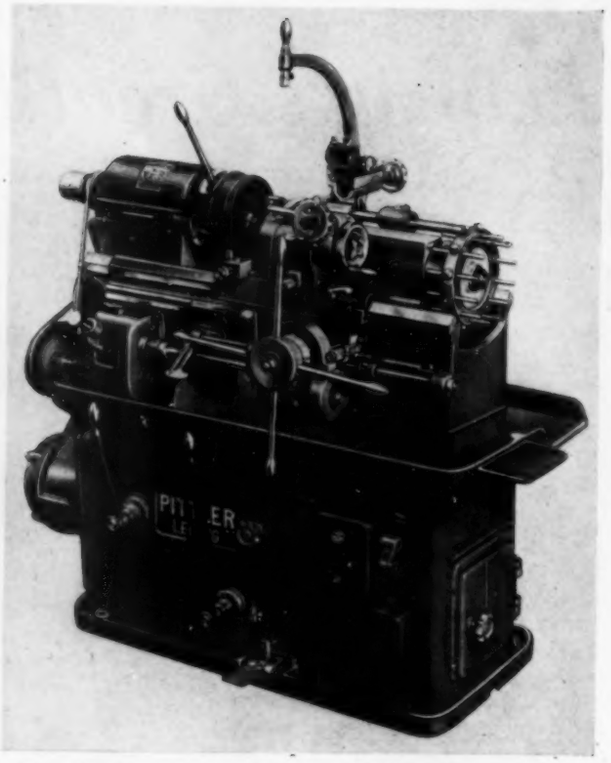
Although there is much of interest to readers of *American Machinist* in practically all of the exhibits at the technical fair no attempt will be made here to mention other than the high spots of the many comprehensive displays in Building 9, the machine tool hall. Also, no attempt will be made to list all that is to be seen there, partly because space does not permit, partly be-



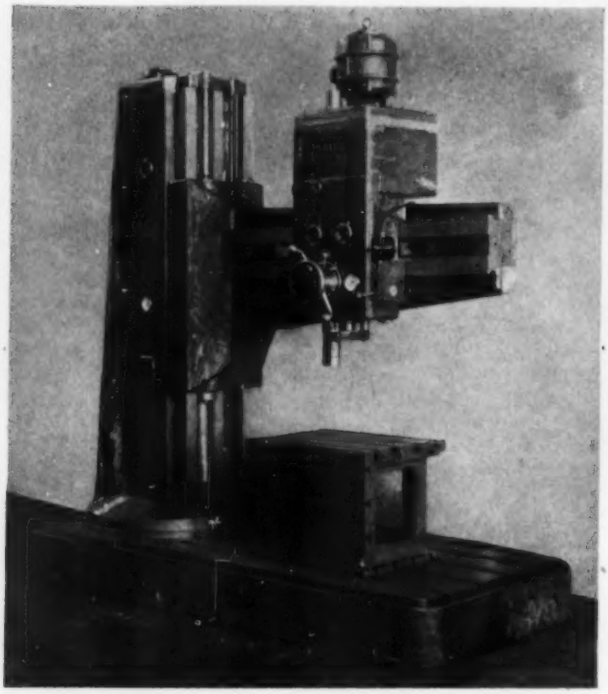
In the Sonntag bending and folding brake with push button control and electrically welded columns and bed, the front guide is adjustable by the small hand cranks shown and the amount is indicated on graduated flexible steel tapes. Drive is by V-belts from a 10-hp. motor and an automatic depth gage is shown at the right of the push button



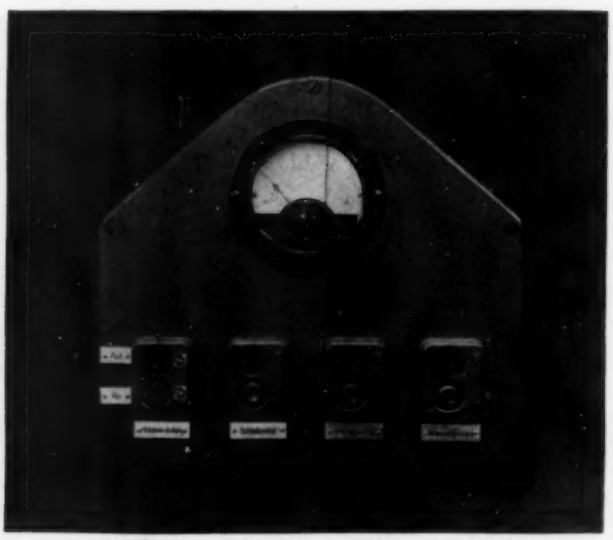
Schmaltz radius grinder, designed for finishing fairly large radii on automobile die parts, has a bellows protecting the ways, which are typical of grinding machine construction



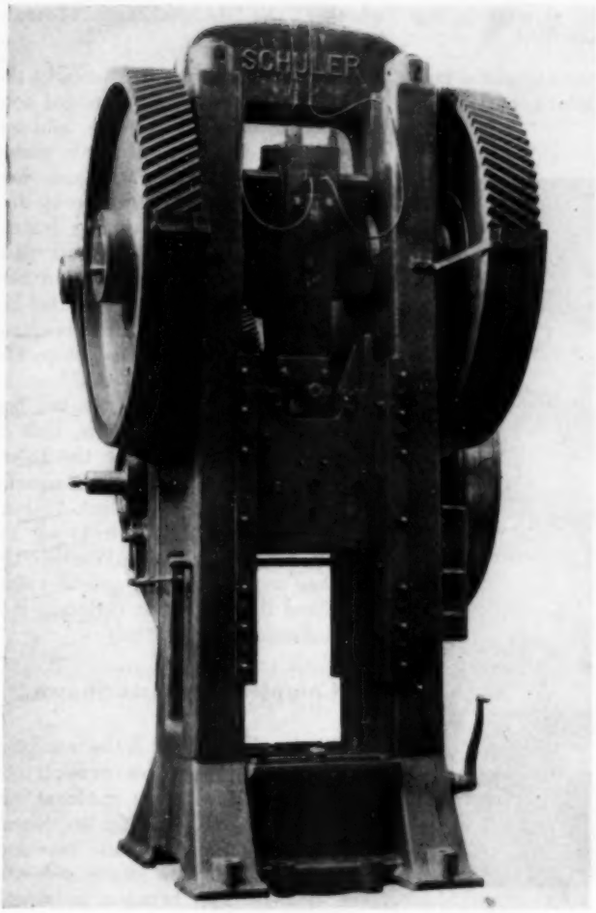
On Pittler's new small screw machine, having a top speed of 2650 r.p.m., the turret has twelve holes and is readily interchangeable so that set-ups for recurring jobs may be left intact. Single-pulley or two-speed motor drive and pick-off gears give eight spindle speeds. While designed for work on brass, aluminum and light alloys it is suitable also for iron and steel. Flexible V-belt drive relieves spindle from strain

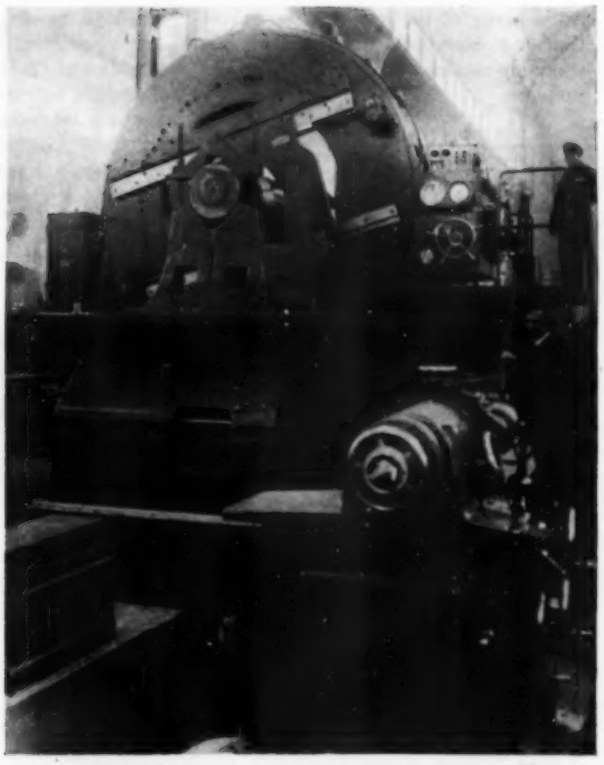


Heller reverts to an older design of radial drill column in order to secure greater rigidity. Spindle speeds from 48 to 2150 are available in the smallest model, 10 to 1320 in the largest



A clean-cut meter and push button switch installation on the side of a machine tool column is typical of German instrument design





Schiess-Defries crankpin lathe is one of the most impressive big machines in the exhibition. This is the machine which has the photo-cell relay device for emergency stopping as described in the text

The Schuler deep drawing press, with 3-ft. stroke and 320-ton pressure, is 20 ft. high and operates at 7 strokes per min. A centralized greasing system is fitted to save time and insure correct lubrication

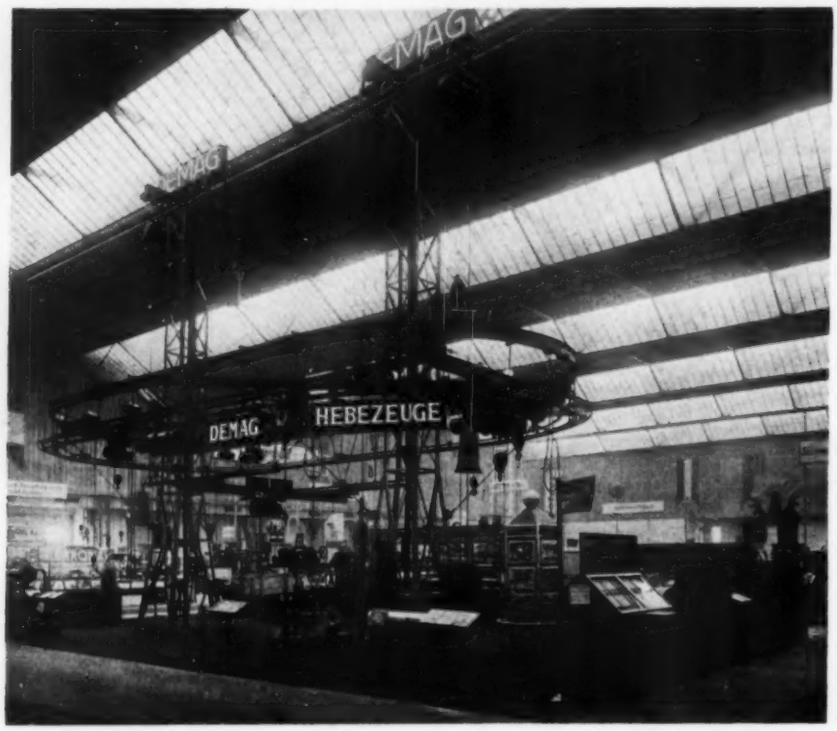
Schulze & Naumann plate planer has a chain driven double circular searfing and planing tool head. This is one of the smaller sizes made by this company. The circular tools can be set at different angles to produce vertical and angled edges for welding

cause many of the machines on exhibition are essentially similar to corresponding models produced by American builders.

On the whole, the arrangement is attractive, compact and efficient. The most serious defect is the necessity of keeping the big building as nearly heat-tight as possible during early March because then German weather leaves much to be desired. With no chance for ventilation the air by night is translucent rather than transparent. As might be expected the eating facilities are inadequate, but they are better than those at the Chicago Century of Progress Exposition, at least during the first few weeks.

A pleasing effect results from the universal use of a standard dark gray paint on all the machine tools shown. Generally speaking it would be hard to tell just by looking at them where the designs of most of the tools originated. If the names were obliterated it would take a keen observer to tell whether the designs were German, British or American.

In the heavier tools, particularly the presses, brakes and shears, welded construction is common practice, and extremely well handled. Multiple motor applications of both standard and flange-type motors are numerous and built-in gages and measuring instruments of various kinds are noticeable to an American. No increase in this tendency is evident, although the big Schiess-Defries crankpin lathe boasts a photo-cell relay control that stops the machine if one shouts "Halt!" at it. It is located near the base of the bed and is further remarkable in that it would have been effective on the Tower of Babel, because it functions equally well to the English equivalent, "Stop!" or the German "Halt," or to an explosion, for that matter. Whether the unit has any material practical value, it is hard to say, but it certainly is a grand show feature.



Demag's display of chain blocks, hoists and other handling equipment dominates Hall 7. The building itself is a remarkable example of clear span construction

The booth of the Association of German Engineers (VDI), with its wealth of published material, for sale, was completely surrounded by engineers during most of the fair

Complete Layouts Shown

In several of the booths complete manufacturing sequences were in evidence. Bolts were being made at one stand, from cold heading to thread rolling; production on these machines varied from 18,000 to 22,000 pieces in nine hours. The hexagon or square head is made in two operations, the first forming the head complete except for a small fin which is cut off in the second operation.

Cans are being made at the stand of a maker of can machinery, the conveyor connections between the several machines being well worked out. This display, the one just mentioned and one or two other similar ones proved effective in attracting visitors, but there was no way of telling how many were real buyers and how many were merely curious.

Questions asked of exhibitors brought out the fact that a certain number of orders were being taken although most of the companies seemed to be more or less indifferent about it. After all, who wouldn't be somewhat indifferent if his plant were booked solid for ten months and he had three shifts working 48 hours apiece? Several British agents for German firms complained bitterly at the loss of orders through failure to make deliveries.

EDITORIALS

VOLUME 79 AMERICAN MACHINIST ESTABLISHED 1877 McGRAW-HILL PUBLISHING COMPANY, INC. NUMBER 7

K. H. CONDIT F. H. COLVIN
EDITORS

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Collective Bargaining

IN HIS recent analysis of Section 7a of the National Industrial Recovery Act, Walter Lippmann points out the great defect in this clause and the cause of its breakdown. While the right of labor to organize can be protected by law, collective bargaining cannot be; bargaining has for its objective voluntary agreement which, by definition, is not subject to compulsion. Mr. Lippmann concludes that, "The Wagner bill ought to be rewritten radically along this line. For, as it is now written, it simply adds pressure to enforce an inherently unenforceable law."

The Wagner bill, by increasing the power of the Labor Relations Board, would force an exaggerated attempt to continue a principle already proved unworkable.

Even supporters of the Recovery Act have admitted its failure to promote recovery. More than any other part of the statute, Section 7a has definitely and continuously retarded a return of prosperity. It has caused smoldering labor differences to burst into flame; it has created friction where none existed before. Strikes, walkouts and lockouts have cut into the country's total payroll, drying up buying power, curtailing both consumer and industrial sales.

Section 7a has held out to workers a false promise, on which has been built the fabulous misrepresentations of labor agitators, who sought to add to their own power and pocket. Its net achievements have been nil, because its wasteful consequences have hindered the profitable operation that would have made it possible for manufacturing enterprises to improve conditions for their employees.

Some Washington observers believe that Senator Wagner's switch to vote for the Administration on the "prevailing wage" provision of the work-relief bill was a bid for support of his own labor bill. Labor lobbyists are making the bill a rallying point in order to recover some of their lost prestige with their rank and file.

IF CONGRESS sees the situation in its true light, it is inconceivable that it will deliberately extend and augment legislation which induces destructive labor strife. It has the opportunity now to take corrective measures by recognizing government's proper and practical degree of regulation in labor relations. Arbitration and mediation can be fostered. But any attempt to legislate a system of collective bargaining is predestined to fail in everything but a prolongation of social unrest.

War Clouds

DURING the hearings before the Special Committee of the United States Senate Investigating the Munitions Industry, last December, the War Department made a statement unfavorable to the nationalization of munitions manufacture. It recommended, instead, a continuance of the policy whereby a nucleus of government production is augmented when needed by private industry.

Government arsenals, in addition to their own production, serve as a check on prices and quality of purchased munitions. To fill these functions efficiently, they should lead the way in the adoption of modern methods and equipment. Only in this way can the arsenals establish a high standard of production for private contractors to follow and be in a position to instruct independent suppliers of munitions in well devised manufacturing technique.

Unfortunately, the arsenals are not in this position today. Despite well organized personnel, with a thorough understanding of the technical problems involved, they are handicapped by a lack of modern machinery upon which to base their methods. Equipment that has seen Civil War service is still employed; machinery acquired since the World War forms a pitifully small percentage of their total facilities.

Saber rattling in Europe grows louder each day. This country does not want war and will resist entry into one if it should materialize abroad. But we cannot ignore the experience of eighteen years ago nor forget that lesson of unpreparedness. We have tested for ourselves the truth of the statement that battles are won behind the lines as well as at the front; no non-combative activity is more vital during wartime than munitions manufacture.

Our arsenals badly need thorough modernization, starting with a survey of processes and facilities that have become available within the past few years. Traditional methods should be open to suspicion unless they can be defended successfully against newer practices that private industry has found to be effective.

On these pages and elsewhere have been reported new equipment and technique covering nearly every phase of shop practice. Advances in welding, plating, heat-treating, broaching, milling and many other metal-working operations have been traced. By far the greater proportion of these better methods have come into use since any appreciable amount of arsenal equipment was replaced. All of these improvements, applicable to arms making, must be adopted if the arsenals are to be put in such physical condition that they will serve as outstanding examples of modern manufacturing.

. CHIPS .

Washington—On their thirtieth wedding anniversary, the Roosevelts picknicked, but too many bills and too little leadership are no picnic for Congress . . . However, work-relief legislation seems assured of passage, since efforts both to cut it and to boost it have been defeated . . . Donald Richberg, after recommending a cut in codes from 700 to 181, is made acting chairman of the National Industrial Recovery Board . . . Labor wins a seat on the board with the appointment of Philip Murray, vice-president of the United Mine Workers . . . Clarence Darrow is back again condemning NRA as a foe of the underdog . . . House passes the Patman inflationary bonus bill 318–90, despite the President's warning that he will veto it . . . Senate Munitions Committee receives a radical move to curb strictly war profits and to draft industry in war time . . . Victory for his labor disputes bill is predicted by Senator Wagner . . . Senate Judiciary committee approves the Black 30-hour week bill.

Foreign—Tension in Europe grows, as Germany openly scraps the Versailles Treaty and orders a conscript army of 500,000 . . . General von Seeckt is recalled from Japan, presumably to head the Reich army . . . France's and Italy's protests bring defiance by Hitler, but hope is placed in Sir John Simon's visit to Berlin . . . Meanwhile France doubles her military training period, and other European powers strengthen armament . . . The League of Nations, due to convene tomorrow, faces its greatest test.

Finance—$105,000,000 in new securities registration in one week is seen as a harbinger of a return of private investment . . . Bank clearings last week were the largest for the year and fourteen per cent over 1934 . . . New Dealers hail a 40 per cent rise in tax receipts, which may make unnecessary new sources of federal revenue.

Industry—H. P. Kendall, chairman of the Business Advisory and Planning Council, after a poll of its 52 members, reports business "satisfactory" to 30 per cent ahead of last year . . . S.E.C. head, Joseph P. Kennedy, says New York is giving the rest of the country the "jitters" . . . but New York passes the buck to Washington.

Indicators—Power output for the week of March 16 rises over previous week and is 4.7 per cent over last year . . . *Business Week's* index falls fractionally from 63.2 to 62.6 . . . Steel production is also off slightly to 46.1.

Work-Relief Compromise Breaks Legislative Jam at Washington

WASHINGTON—Out of the jam of pending legislation, the work-relief bill has been shaken loose at last. The drive to crop it by $2,000,000,000 has been repelled. The Russell amendment has been successfully substituted for the McCarran "prevailing wage" amendment, and so the ways seem greased for its early passage. Thus the President will receive history's greatest "blank check," combining both a grant of great power and a pile of political dynamite.

In the compromise over the prevailing wage clause, the President really made no concession. He agreed that prevailing wages would be paid on permanent federal buildings, but there are no funds in the bill, after earmarking, which could be used for that purpose. The action of the Senate in extending the life of the Public Works Administration for two years is proof that this agency will be used in the actual administration of the work-relief act. Some observers contend that it is impossible to spend $5,000,000,000 on public works in one year—that the administration has asked for plenty so it can balance its 1936 budget.

Perhaps the chief beneficiary from the temporary jam was Senator Wagner. Washington wiseacres see in his flopping to the President's support a trade for administration backing for his labor relations bill. If so it was a good trade—for Wagner.

Hearings on the Wagner bill have developed all sorts of oratory about nullification of Section 7a in appeals to the courts by companies which have been victims of adverse rulings by the National Labor Relations Board. So it is demanded that the Wagner bill be passed to "implement" 7a. Some industrialists favor retaining this controversial section, as is, so it can be ruled upon by the Supreme Court once and for all. An interesting phase of the hearings was the protest by Miss Perkins against the proposed Labor Board as an independent body, outside the Department of Labor.

Social security legislation is limping along. Agricultural laborers and domestic servants have been exempted, as have concerns employing less than ten persons. But there are so many other difficulties to iron out that little prospect for final passage is seen until late in the session. Federal-State old age assistance is offering no such trouble and is likely to go through, minus the fantastic Morganthau proposal, to build up a $50,000,000,000 reserve.

One of the reasons the administration is trying to avoid revenue legislation at this session of Congress is a desire to concentrate on the effort to increase income. If incomes could be brought back to the 1929 level, present tax laws would raise enormous sums. As one official phrased it, "our purpose is to restore income not spread poverty."

Table I—Index of Orders, Based on Volume of Shipments for 1926

Month	Index of Orders: Domestic	Foreign	Total	3 Months' Average Index	% Foreign to Total Orders
1934—August	32.4	9.0	41.4	37.1	21
September	29.4	6.8	36.2	37.4	19
October	35.1	8.8	43.9	40.5	19
November	43.1	9.3	52.4	44.2	17
December	51.5	14.6	66.1	54.1	21
1935—January	52.0	13.5	65.5	61.3	20
February	42.1	10.9	53.0	61.5	20

Table II—Index of Orders—By Size of Companies

Month	Index of Orders: Domestic	Foreign	Total	No. of Reports	% Foreign to Total Orders
Group A—Companies reporting year's sales in 1926 of $200,000 or more:					
1934—August	31.4	9.6	41.0	93	23
September	28.7	7.1	35.8	94	20
October	34.9	9.4	44.3	96	21
November	43.4	9.8	53.2	89	19
December	51.3	15.1	66.4	91	23
1935—January	51.6	14.3	65.9	91	22
February	42.1	11.4	53.5	98	21
Group B—Companies reporting year's sales in 1926 of less than $200,000:					
1934—August	44.7	1.0	45.7	76	2
September	39.4	3.1	42.5	81	7
October	37.5	1.7	39.2	82	4
November	38.7	2.1	40.8	82	5
December	55.6	7.3	62.9	76	12
1935—January	57.1	1.9	59.0	78	3
February	42.1	4.5	46.6	81	10

Table III—Distribution of Orders

(Shown by indexes of individual companies)

New orders in % of 1926 shipments	Number of reports in each index group: August	September	October	November	December	January	February
200 or more	6	3	5	4	9	10	6
100–199	8	12	15	15	25	21	19
90–99	5	2	3	4	5	5	5
80–89	7	5	3	4	4	10	3
70–79	3	6	6	7	6	8	10
60–69	9	2	9	9	7	10	8
50–59	12	9	12	12	18	10	18
40–49	14	15	8	16	16	13	18
30–39	18	16	19	16	14	12	21
20–29	23	24	26	17	17	21	23
10–19	27	29	31	23	42	22	18
Less than 10	37	52	41	44	22	27	30
Total reports	169	175	178	171	167	169	179

Dr. Jewett Named Index Fund Chairman

Chairmanship of the campaign to raise working capital of $161,000 for Engineering Index, Inc., has been accepted by Dr. Frank B. Jewett, president of Bell Telephone Laboratories, Inc., and vice-president of American Telephone and Telegraph Co. The fund will be used to save the 50-year old index and annoting service of the engineering profession, discontinued as an activity of the American Society of Mechanical Engineers a year ago.

February Machine Tool Sales Decline Sharply

February, ordinarily a good month in the industry, showed a substantial falling off of machine tool orders according to the latest report of the supervising agency. Business uncertainty is credited with causing a reversal of the upward trend established in the last four months of 1934.

While the latest index of orders is down to 53.0 from 65.5 in January, it is well over the 1934 average of 46.2. The three months' average index, which is used to indicate the trend for the industry, rose fractionally from 61.3 to 61.5, but March sales will have to show a marked increase to prevent a drop in this figure next month.

A reduction in both domestic and foreign orders caused February's curtailed volume. Renewed investment in modern equipment is needed to stimulate the industry, and this is at present retarded because of doubts as to the political outlook and confused labor conditions.

Foreign Shipments of Machinery Increase 78 Per Cent in 1934

WASHINGTON—Exports of machinery last year amounted to $98,348,000, a gain of nearly 78 per cent over the 1933 total of $55,284,000. Growth during the year resulted from a steady accumulation of small increases, since June 1933, and may be considered to be on a sound basis. The following table shows exports of the seven main groups of industrial machinery during 1934, 1933, 1931 and 1929.

During the year, the greatest strides were made in power-driven metal working machinery, which is made up almost exclusively of machine tools. This recovery may be attributed mainly to a growth in technological progress throughout the world and the need for American high quality, high production machinery. While statistics covering trade by countries of destination are not yet available, Europe is the best market for this type of machinery.

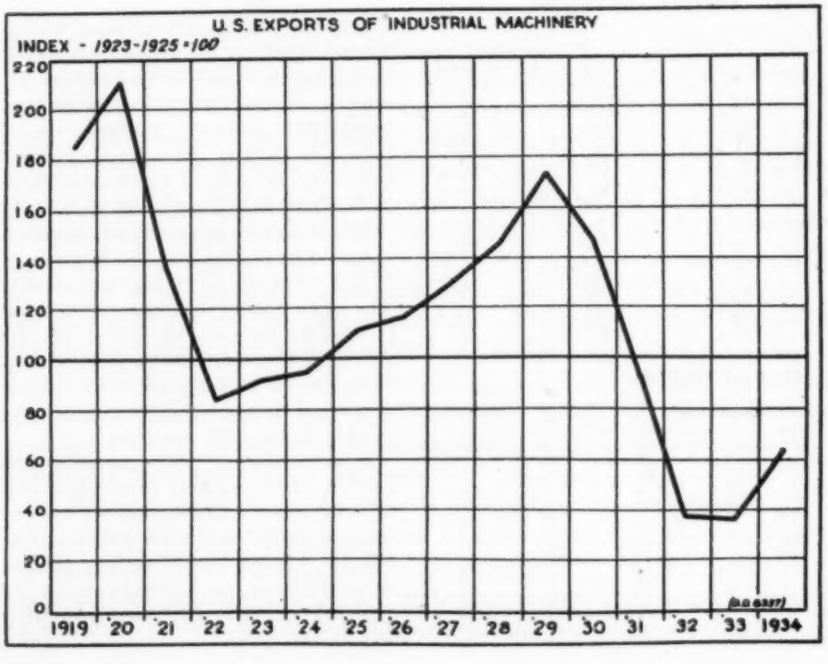
The excellent showing of the textile machinery group also indicates improved conditions, particularly in consumer buying power. Recovery in mining, well and pumping machinery points to growing prosperity in those markets where manufacturing as such is secondary but which produce the bulk of the raw materials. Outstanding in this connection is the improvement which has been made in the Union of South Africa.

Machinery manufacturers must be considerably heartened by the fact that the excellent gain in the year's trade was accomplished with little or no direct artificial aid. Late in 1933, producers looked forward to forthcoming trade with Russia, which had lately been officially recognized. The Russian trade agreement failed to materialize, and now seems definitely out of the picture for the immediate future at least. The Export-Import Banks were set up but did not function materially in the case of machinery. Reciprocal trade agreements hardly contributed to the gain because they have only recently been concluded with but three countries, Cuba, Brazil and Belgium.

Perhaps the most disturbing factor in machinery export trade during 1934 was the lack of long-term credit facilities. Years of depression had so depleted surpluses of machinery manufacturers that it was virtually impossible for them to finance many orders which would have been theirs otherwise. Foreign competitors were quick to take advantage of their opportunities in this respect and secured numerous good orders for all types of machinery, simply by granting credit, in some cases up to ten years.

Exports of Industrial Machinery
(Value in Thousands of Dollars)

	1934	1933	1931	1929
Power Generating Machinery, except Electric and Automotive	6,598	3,845	12,671	29,091
Construction & Conveying Machinery	5,533	2,813	12,371	26,485
Mining, Well & Pumping Machinery	24,201	13,504	25,256	54,449
Metal Working Machinery, Power Driven	19,434	8,158	36,027	33,439
Other Metal Working Machinery	2,345	1,211	4,003	7,365
Textile, Sewing & Shoe Machinery	15,449	9,825	12,716	27,834
Other Industrial Machinery	24,788	15,926	39,106	89,157
Total	98,348	55,282	142,150	267,820



A.M.A. Conference to Discuss Social Attitude

Production problems arising out of new social attitudes toward industry will be the general subject of seven sessions to be held at the Hotel Statler, Cleveland, Ohio, by the Job Order and Mass Production Conference, on April 18 and 19. Speakers and phases of this topic they will present are as follows:

THURSDAY, APRIL 18

Theme—Practical Application of Improved Managing Methods to the Job or Other Plant.

O. D. Reich, vice-president, Dexter Folder Co., presiding.

10 a.m. Preparing the Personnel for the Effective Introduction of Modern Management Methods, by Stanley T. Fisher, assistant to works manager, American Hard Rubber Co.

Leaders of discussion: Dr. W. P. Edmunds, manager, Industrial Relations Department, Standard Oil Co. (Ohio); T. O. Kennedy, vice-president and general manager, the Ohio Public Service Co.; Bryan Houston, Labor Adviser.

11:15 a.m. Preparation of Product Facilities for Effective Installation of Standard Production Practice in a Job Order Plant, by Harold V. Coes, manager, industrial department, Ford, Bacon & Davis, Inc.

Leaders of discussion: A. J. Graf, works manager. R. Hoe & Co.; R. H. Goodwillie, works manager, Yonkers plant, Otis Elevator Co.

2 p.m. How a Job Order Production Man Can Make Practical Use of Time and Motion Study and Wage Incentive by Lee D. Tidball, manager, Time Study and Standards, Miller Rubber Co. division, B. F. Goodrich Co.

Leaders of discussion: Professor Erwin H. Schell, Department of Business and Engineering Administration, Massachusetts Institute of Technology; A. A. Hadden, partner, McLure, Hadden & Swisher; Philip H. Cone, assistant general manager, Cincinnati Milling Machine Co.

3:30 p.m. Application of Standard Costs and Budget Control to Job Order Production, by T. R. Sullivan, manager, Industrial Department, Peat, Martwick, Mitchell & Co.

Leaders of discussion: H. J. Cochran, auditor of production, Addressograph-Multigraph Corporation; H. J. Bechtold, auditor, the Ohio Rubber Co.; F. I. Newbury, general manager, machinery engineering, Westinghouse Electric & Mfg. Co.

Col. M. C. Rorty, president, American Management Association, presiding.

7 p.m. Topic—Social responsibilities of the modern industrial executive, by O. G. Saxon, professor of business administration, Yale University.

FRIDAY, APRIL 19

Theme — Gearing Mass Production Methods to Present Day Conditions. Glen Gardner. Forstmann Woolen Co., presiding.

10 a.m. How to Achieve Flexibility in the Utilization of the Labor Force in Mass Production, by D. W. Weed, general manufacturing department, General Electric Co.

Leaders of discussion: E. M. Richards, chief industrial engineer, Republic Steel Corporation; C. D. Donovan, vice-president and assistant general manager, Norge Refrigerator Co.; H. C. Beal, operating superintendent, Hawthorn Works, Western Electric Co.

11:15 a.m. Economics of the Introduction of Improved and Specialized Equipment in the Mass Production Plan, by A. J. Brandt, vice-president, Hupp Motor Car Corporation.

Leaders of discussion: Raymond F. Perry, vice-president, Ingersoll Milling Machine Co.; E. S. Dawson, general superintendent, The Deming Co.; F. W. Jackson, assistant vice-president, American Appraisal Co.

2 p.m. Controlling Overhead Ratios in Times of Wide Fluctuation in Mass Production Schedules, by Edmond S. LaRose, assistant controller, Bausch & Lomb Optical Co.

Leaders of discussion: F. V. Gardner, manufacturing general department, General Electric Co.; C. S. Cragmile, vice-president, Belden Manufacturing Co.; Alfred Dangler, Jr., vice-president, the Trundle Engineering Co.

3:30 p.m. Incentive Trends in Mass Production, by R. F. Whistler, head of the standards department, National Cash Register Co.

Leaders of discussion: Caroll E. French, Industrial Relations Counselors, Inc.; Frank J. Oliver, Industrial Coordinator, College of Engineering, University of Detroit; H. H. Tullis, supervisor of compensation and production standards, American Rolling Mill Co.

Chicago Group to Hold Machine Shop Meeting

On Thursday, March 28, the Chicago Section of the American Society of Mechanical Engineers is holding a special meeting in the auditorium of the Engineering Building. At both afternoon and evening sessions there will be a demonstration of machine tools in operation. The program will be as follows:

2:30 p.m., "High Speed Machining for High Speed Transportation," P. S. Jackson, assistant manager, Rockford Machine Tool Co.; "High Speed Tapping," H. Goldberg, vice-president, R. G. Haskins & Co.

7 p.m., "The Romance of Perfect Lubrication," H. A. S. Howarth, vice-president and general manager, Kingsbury Machine Works, Inc.; "Probable Trends in the Machinery Industry of 1935," R. E. W. Harrison, chief, Machinery Division, Department of Commerce; "The Development, of High Speed Production Machine Tools Recently Installed in Detroit," R. A. Schafer, chief designing engineer, The National Automatic Tool Co.

Motor Production Continues Strong But Tool Orders Are Still Scarce

DETROIT—January production of 303,372 units was increased to 355,350 in February, according to the Automobile Manufacturers Association, and March production is expected to run well over 400,000. There is evidence now that the industry will continue at the present high level through May, barring the unexpected. Buying commitments for essential materials, placed before March 15, indicate only a slight slackening in May production with April in line with February and March.

With 136,635 passenger cars and 34,750 trucks registered in January, February figures are anticipated to be better by 60,000 and 10,000 respectively. The shortage of trunk sedans continues acute, and some companies are calling in dealers to explain why cars cannot be delivered fast enough to meet dealer orders. January and February comparisons with last year are flattering for all companies but meaningless because of last year's failure to get into volume production before March 1, as a result of the toolmakers' strike. That there is a vast potential replacement market still available can be observed in the number of old models on the streets in any city. Some estimates place the 1935 business to date as 90 per cent due to replacements. Observers call attention to the fact that employees have been added to payrolls too recently to permit them to clear up old debts and give sustained support to such a rapidly expanding output. However, time sales are creeping up on cash sales which is evidence that workmen buying on a contract basis are coming in to support the market.

Plymouth, for the week ended March 9, increased retail deliveries 4 per cent over the previous week. Olds, for the

• INDUSTRIAL REVIEW •

• Machinery sales continue to reflect the conflict between a strong economic need for replacement and a lack of confidence in the future, directly traceable to Washington. With NRA considered to be fading, industry's chief causes for alarm are the Wagner labor relations bill and the Black 30-hour week bill. Either of these pieces of proposed legislation would, if passed, seriously hinder industrial recovery. As a result business is spotty and unpredictable.

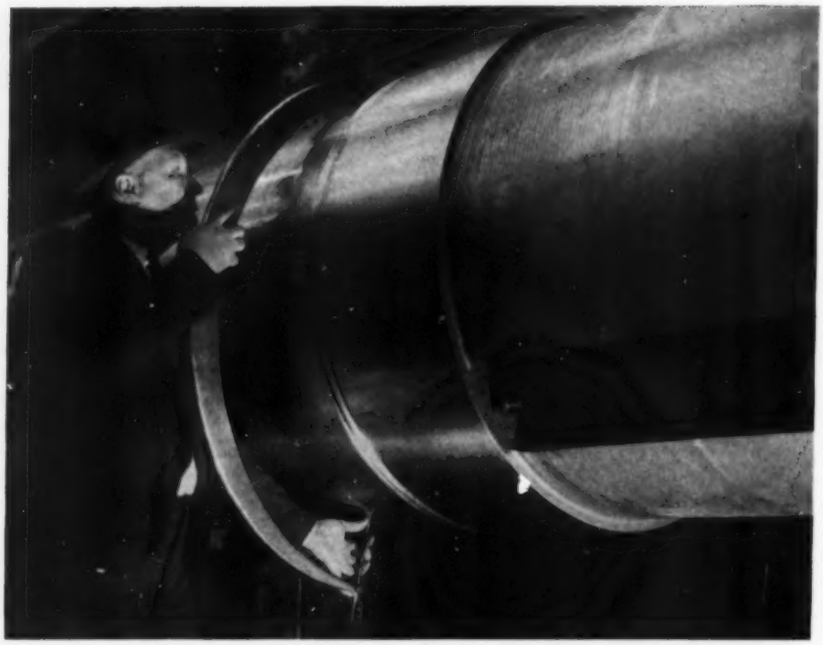
• New England plants have inquiries out for thousands of dollars worth of business but are delaying the placing of orders. The New York district is happy over the fact that March business is keeping pace with a satisfactory record in February. Everywhere the ability of business to hold its own despite current uncertainty is considered an indication of fundamental constructive influences.

• Philadelphia finds actual orders meager but looks ahead to an improved volume. Sales in Pittsburgh, while still below normal, show slow improvement. Barring labor difficulties modernization plans should soon be released.

• Cincinnati also reports a slight betterment in sales and feels that, if unhampered, business would assume a sustained upward trend. Influenced largely by the automobile industry, Toledo had the best January and February in four years. Parts manufacturers now anticipate some drop-off in business and consequently are deferring new commitments.

• Detroit sees ahead a fair amount of activity until June and then a less than seasonal slump because of the introduction of new car models in the fall. Tool and die shops will be kept busy during the summer but, at present, hand to mouth buying prevails. Encouraging notes are that recent inquiries have been for standard machines and that labor conditions are good.

• Chicago is experiencing a lull with occasionally orders for single machines. However, current business is considerably above the November level. Sales in St. Louis continue fairly brisk, and small tool demand, which is a good barometer, continues steady. Nevertheless, many executives are concerned about the political outlook.



***A Big Shaft Is Miked*—One of the Boulder Dam generators takes this 106,000 lb. shaft, 32 ft. 8 in. long, 38 in. diameter at the body and 65 in. at the flange. A Westinghouse inspector is shown checking dimensions on the finished part**

first ten days in March sold 72 per cent more cars than the previous record set in March 1929, and exceeded the 1934 total by 320 per cent. Chrysler dealers sold more Chrysler and Plymouth cars the first nine weeks of 1935 than for the same period of 1933 and 1934 combined. Pontiac, with the best February in six years, reports a current increase in unfilled orders of 18 per cent. Dodge sold 3.5 per cent more cars the week ending March 9 than the previous week and is now working toward an output of 1,300 per day. Dodge will also increase truck producing facilities for the first expansion, aside from Ford, since the depression began. Truck deliveries for this company are now running ahead of the near record year of 1934 by 30 per cent. Hudson reports the best business to March 2 since 1930. Packard is striving for 200 per day of the 120 model, and De Soto, for the first quarter, will ship almost as many cars as for the whole of 1934.

Sales of General Motors cars to dealers in this country for January and February were 131,402 as compared with 82,349 last year. Ford is rapidly working toward an output of 7,000 per day with truck production somewhat hampered by the pressure for passenger cars.

With no evidence at present that stocks are accumulating, and the early fall introduction of 1936 models settled, the industry seems destined for a considerably better year than 1934. Exports lend support to this belief; in January, 38 per cent more passenger cars were sent abroad than in December and 58 per cent more than in January of 1934.

The size of the automobile industry in this country is shown best perhaps by comparison with other countries. The Department of Commerce states, "it is estimated that total sales of new vehicles in Japan proper amounted to 29,000 units in 1934, an increase of 100 per cent compared with 1933."

Tools and Equipment

Extensive and sustained buying of new equipment must depend largely on car profits, baring major chassis changes. Chrysler reported a 32.5 per cent increase in 1934 sales with a 21.4 per cent drop in profits, due to increases in operation costs. First quarter profits are not yet available. Press equipment, which enjoyed high sales from November to March 1, has been in a decided slump since, but with no used machines available. Buying machinery to bolster high output, with one exception, has not developed as expected. One large company is however calling for prices on standard equipment, looking, it is hoped, toward a general replacement program. Some inquiries for new models of equipment are in evidence, but are not extensive.

Reductions in force at tool and die shops are now being made as this activity is entering the slack season. Work on models for summer introduction is going on, but generally it has not as yet reached the tooling stage, and there is not enough maintenance work to take up the slack. Production tool plants are still doing volume business with a let-down not anticipated till late April. Sentiment in both these industries anticipates a short slack season because of the October 1 introducing date.

That the price structure is a bit uncertain is further evidenced by two announcements in mid-March; Studebaker and Nash lowered prices up to $60 and $70 respectively. Plymouth added a four-door business sedan to the low priced coupe and two-door sedan announced a short time ago.

Labor Relations

With a total of 128,925 ballots cast to date in the Automobile Board elections the unaffiliated group leads with 71½ per cent, employee associations 12 per cent, the A. F. of L. 6¾ per cent; eleven unions account for the remainder. At the International Harvester plant election, in Fort Wayne, handbills advocating an A. F. of L. slate were distributed for the first time. In Flint 3,520 votes out of 33,735 eligible workers were cast for the Federation.

Refusal of the A.M.A. to negotiate with the Federation is based on its small strength shown in the voting and the Federation's repudiation of the President's settlement of March last year. While the likelihood of a Federation sponsored strike is discounted, it is unfortunate that organized labor seems to have manoeuvered itself into a position where a strike may seem necessary to save face.

The industry was helped over a bad spot February 18 in the permission granted fabric plants by the code authority to add a third shift to run till the middle of May. This easing of production restrictions avoided a curtailment of assembly schedules.

April 10 is set as the formal opening date for the Chevrolet assembly plant in Baltimore, though actual production will begin earlier; 300 per day is the planned output.

Dealers were shown the new LaSalle on March 11 and 12, priced lower than last year. . . . The Department of Agriculture is calling for bids on 18,700 motor trucks. . . . A pageant of transportation is scheduled for Detroit early in May at which a drive away of 1,000 cars is planned.

• PERSONALS •

COL. F. H. PAYNE

COL. FREDERICK H. PAYNE, chairman of the board, Greenfield (Mass.) Tap & Die Corp., has been elected president to succeed CHARLES N. STODDARD, who will practice law. DONALD G. MILLARD, of New York, was elected chairman of the board. Other officers are: FRANCIS A. SMITH, vice-president; W. BELTRAN DU MONT, vice-president; L. W. GRAHAM, treasurer, and FRANCIS A. SMITH, secretary.

WILLIAM J. O'NEIL has been made general manager of the Dodge Brothers Corporation, Detroit. By the appointment of Mr. O'Neil, K. T. KELLER, president of Dodge Brothers divests himself of the general managership. Mr. O'Neil first went with the Dodge Division in 1928, but in 1921 became associated with WALTER P. CHRYSLER. He has held the positions of superintendent of the Beaver Mfg. Co., the Petrol Motor Car Co., and the Michigan Buggy Co., and has also headed the gas engine department of Fairbanks, Morse & Co. At one time he was production manager of Montgomery-Ward and also held a like position with the A. O. Smith Corp.

JAMES R. BUCK has been elected chairman of the Federal Screw Works, Detroit, and will also serve as president for a time. P. E. GARLENT and E. W. STEWART have been named vice-presidents. R. A. GUNN and E. E. VENDER, previously president and treasurer respectively, have resigned.

FRANK J. TONE, president of the Carborundum Co., Niagara Falls, N. Y., will receive the Edward Goodrich Acheson International Medal and prize of $1,000 from the Electro-Chemical Society. Mr. Tone has developed many materials and processes for the electric furnace industry.

E. H. SCHWAB, of New York, has been elected chairman of the board of the reorganized Herbrand Corp., Fremont, Ohio, producer of drop forgings. Other officers chosen are: STANLEY S. BOYER, president and general manager; R. O. MEAD, Detroit, vice-president, and C. TRAUB GOTTRON, secretary and treasurer.

J. C. KAIMER, for the past twelve years engineer and representative for the O. K. Tool Co., has joined the Apex Tool & Cutter Co., Inc., Shelton, Conn., as engineering and district sales manager for inserted tools in the New York, New Jersey and Pennsylvania territory.

DAVID BENJAMIN has resigned as vice-president and director of the Gabriel Co., Cleveland.

• OBITUARIES •

F. C. THOMPSON

FRED CRAWFORD THOMPSON, 51, vice-president and general manager of the Morse Chain Co., a subsidiary of the Borg-Warner Corp., died March 6. Mr. Thompson started as a draftsman with the Westinghouse Electric & Manufacturing Company, and later was associated with the Pope-Toledo Co., as a designing engineer. He was also connected with the Fairbanks-Morse Co. and the Buda Co. In 1914 he joined the Morse Chain Co., as Detroit manager, and during the last five years has held the position of vice-president and general manager.

WILLIAM B. ALEXANDER, general superintendent and a director of the National Screw & Manufacturing Co., died at the age of 50 in Cleveland. He is survived by his brother, HAROLD ALEXANDER, who is president.

JAMES F. LEAHY, general superintendent of the Buffalo (New York) plant of the Farrel-Birmingham Co., Inc., died March 6. Mr. Leahy had served as machine shop foreman at the Ansonia plant before being transferred to the superintendency at Buffalo twelve years ago. He was an expert in gear cutting, and was one of those who investigated the gear cutting process invented by W. E. SYKES, and for which the plant at Buffalo was acquired for the manufacture of Sykes gear machines, gears and related products.

JOEL S. COFFIN, 70, chairman of the board of the Locomotive Mfg. Corp., which operates the Lima, Ohio, locomotive works, died March 11.

HARRY DUNN, vice-president in charge of purchases of the Auburn Automobile Co., died March 1, from pneumonia. He directed the company's purchasing policy since 1932.

WILLIAM W. WATSON, 58, president of the Watson Mfg. Co., Jamestown, N. Y., metal products manufacturer, died March 18.

CARLETON S. WHITNEY, president of the Dover Stamping & Mfg. Co., Cambridge, Mass., and secretary of the Sheet Metal Association, died March 5. Mr. Whitney was 38.

• MEETINGS •

AMERICAN MANAGEMENT ASSOCIATION. Joint conference of the Job Order and Mass Production Divisions, April 18-19. Hotel Statler, Cleveland. American Management Association, 20 Vesey St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Machine Shop Practice Meeting and Exhibit, afternoon and evening, March 28. Engineering Bldg., 205 W. Wacker Drive, Chicago. C. B. COLE, chairman, 4625 Fulton St.

• BUSINESS ITEMS •

The machinery and equipment of the Willys-Morrow Co., Inc., Elmira, N. Y., will be sold piece by piece at auction April 2 to 5 inclusive, starting at 10 A.M. each day, by the Industrial Plants Corporation (Ohio), Administration Bldg., Toledo, Ohio.

For the purpose of providing improved service to its licensees, United Chromium, Inc. has moved its office and laboratory to larger quarters at 2751 East Jefferson Ave., Detroit.

• EXPORT • OPPORTUNITIES

Andrews & George Company, 5 Shiba Park, Tokyo, Japan, wants prices aboard ship of twelve motor-driven, high-speed precision lathes, 10 in. swing by 20 in. between centers. Spindle speeds: 400-2,500 r.p.m. in six changes: 800-2,500 r.p.m. in three changes. Additional information on request to *American Machinist*.

Cooking installations, steam; laundry equipment, ironing machinery and clothes sterilization plant for a hospital. *8577. Santiago, Chile.

Engines, marine, small, crude oil or kerosene. *8570. Batavia, Java.

Floor sanders for polishing and sanding floors. *8587. Calgary, Canada.

Rubber-thread manufacturing machinery. *8588. Amsterdam, Netherlands.

Engines, marine, diesel and semi-diesel, for fishing boats and small vessels. *8649. Athens, Greece.

Lithographing machines, off-set, small, electrically operated. *8647. Mixcoac, Mexico.

Orange cleaning, peeling and separating machines. *8625. Athens, Greece.

Paint and enamel manufacturing machinery and equipment. *8628. Brussels, Belgium.

Paper goods and container manufacturing machinery, for making napkins, embossing, printing, folding and packing. *8623. Athens, Greece.

Tractors, small, wheel-type, diesel; horse-drawn plows; garden implements, and harrows. *8648. Haifa, Palestine.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

Corporation Reports

Company	1934 Earnings	1933 Earnings
American Laundry Machinery Co.	d$687,024	d$1,187,284
American Machine & Metals, Inc.	$28,042	d$62,011
Bliss, E. W., Co.	d$281,584	d$536,819
Canadian Locomotive Co., Inc.	d$55,520	d$56,384
Carrier Corp.	d$86,582	d$673,616
Chicago Nipple Mfg. Co.	d$30,606	d$102,537
Consolidated Aircraft Corp.	$6,560	d$9,135
Fairbanks, Morse & Co.	$563,847	
General Electric Co.	$17,151,000	$10,855,000
Graham-Paige Motors Corp.	d$474,959	$66,997
Hayes Body Corp.	d$121,670	d$288,382
Hercules Motors Corp.	$214,506	$76,515
International Business Machines Corp.	$6,597,362	$5,736,424
Landers, Frary & Clark	$514,165	$236,409
Mahon, R. C., Co.	$116,939	$26,192
Marchant Calculating Machine Co.	$102,320	
McGraw Electric Co.	$502,950	$105,550
McQuay-Norris Mfg. Co.	$478,580	$376,775
Motor Products Corp.	$135,385	d$216,752
Mullins Mfg. Corp.	$186,504	d$268,427
Murray Corp. of America	d$798,363	d$792,851
National Cash Register Co.	$1,115,631	$579,623
National Enameling & Stamping Co.	$372,591	$274,097
Neptune Meter Co. of N. J.	$265,399	$127,350
Niles-Bement-Pond Co.	$25,485	d$276,643
Northwest Engineering Co.	$21,612	d$111,834
Perfect Circle Co.	$549,762	$397,039
Pyrene Mfg. Co.	$91,925	d$103,151
Remington Arms Co.	$142,589	
Sangamo Electric Co.	$197,644	d$63,655
Shaler Co.	$76,887	$34,535
Simmons Co.	d$948,563	$50,679
Spang, Chalfant & Co.	$820,812	d$910,692
Springfield Mfg.	d$252,217	d$267,274
Stewart-Warner Corp.	$571,968	d$1,791,060
Studebaker Corp.	d$1,461,985	d$4,876,307
Superheater Co.	$502,246	$315,955
Timken-Detroit Axle Co.	$426,125	d$1,256,869
Timken Roller Bearing Co.	$3,486,058	$2,172,850
Tung-Sol Lamp Works, Inc.	$200,704	$163,242
United American Bosch Corp.	$50,101	d$10,666
United-Carr Fastener Corp.	$498,088	$304,711
Vortex Cup Co.	$423,210	$358,405
Westinghouse Air Brake Co.	$656,398	d$659,560
White Sewing Machine Co.	d$82,129	d$420,651
Wilcox-Rich Corp.	$548,461	$341,150

d—Deficit.

• PATENTS •

March 5, 1935

Metal-Working Machinery

Rail Heating Apparatus. Royal E. Frickey, San Francisco, and Arion S. Kalenborn, Redwood City, Cal., assigned to Welding Service, Inc. Patent 1,992,943.

Machine for Grinding Shuttle Points. Eugene Le Blanc, Leominster, Mass. Patent 1,993,064.

Crank Shaft Lathe. Rudolf Dreverhoff, Brooklyn, N. Y. Patent 1,993,363.

Drill Grinding. James S. Symser, Boston, Mass. Patent 1,993,418.

Machine for Honing and Polishing Crank Shafts. Walter F. Egger, Cleveland, Ohio, assigned to Norton Co. Patent 1,993,543.

Tools and Attachments

Tape Coiling. Clarence B. Hayward, Nutley, N. J., assigned to Mayhew Steel Products, Inc. Patent 1,992,947.

Spot-Welding Electrode. Bruce Burns, Santa Monica, Cal., assigned to the Northrop Corp. Patent 1,992,990.

Punch Ejector Die. Samuel Singer, Philadelphia, Pa. Patent 1,993,041.

Processes

Packing of Rotary Cutters. Robert A. Hornder and Arthur B. Brand, Rockford, Ill., assigned to Barber-Colman Co. Patent 1,992,950.

Method of Making One-Piece Ribbed Tubing. Albert T. Light, York, Pa., assigned to York Ice Machinery Corp. Patent 1,993,066.

Process of Grinding Gears. Arthur L. Stewart, Rochester, N. Y., assigned to Gleason Works. Patent 1,993,120.

Method of Case Hardening Articles. Walter Beck, Frankfort-on-the-Main, and Klaus Bonath, Cronberg-in-Taunus, German, assigned to Deutsche Gold & Silber Scheudeanstadt. Patent 1,993,204.

Method of Manufacturing Pipe Fittings. Edward S. Cornell, Jr., Larchmont, N. Y., assigned to American Radiator & Standard Sanitary Corp. Patent 1,993,361.

Aluminum Solder. Friedrich Strasser, Basel, Switzerland. Patent 1,993,490.

Pipe Trimming Apparatus. William B. Meglitz, Berlin, N. H., assigned to Brown Co. Patent 1,993,561.

March 12, 1935

Metal-Working Machinery

Grinding Machine. Swan E. Bergstrum, Detroit, Mich., and George W. Binns, Robert E. V. Harrison, and Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders, Inc. Patent 1,993,822.

Grinding Machine. Richard E. Conover, Deer Park, Ohio, assigned to Cincinnati Grinders, Inc. Patent 1,993,830.

Apparatus for Producing Surfaces of Revolution Eccentric to One Another. Albert H. Dall, Cincinnati, Ohio, assigned to Cincinnati Grinders, Inc. Patent 1,993,831.

Grinding Machine. Charles Herfurth, Cincinnati, Ohio, assigned to Cincinnati Grinders, Inc. Patent 1,993,840.

Portable Welding Machine. Frederick J. Groven, Highland Park, and William F. Pioch, Detroit, Mich. Patent 1,993,961.

Orbital Lathe. William F. Groene and Harold J. Siekmann, Cincinnati, Ohio, assigned to the R. K. LeBlond Machine Tool Co. Patents 1,993,994-1,993,995.

Machine and Method for Forming Protuberances on Sheet Metal. Ellsworth W. Carroll, San Francisco, Cal. Patent 1,994,034.

Staple Forming Mechanism. Alfred L. Rosenmund, Rockaway, and George P. Igleheart, Boonton, N. J., assigned to Stapling Machines Co. Patent 1,994,255.

Molding Machine. Albert William Sizer, Hessle, Kingston-upon-Hull, England. Patent 1,994,371.

Tools and Attachments

Holder for Cutter Tool Bits. Ernest Reaney, Bridgeport, Conn., assigned to the O. K. Tool Co., Inc. Patent 1,993,752.

Work Feeding Mechanism for Machine Tools. Edwin R. Smith and William J. Pearson, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co. Patent 1,993,754.

Ferrous Welding Electrode. Robert S. Johnson, Yardley, Pa., assigned to John A. Roebling's Sons Co. Patent 1,993,789.

Welding Rod. Samuel W. Miller, late of Hollis, N. Y., assigned to Oxweld Acetylene Co. Patent 1,993,852.

Cam Grinding Apparatus. Conrad L. Ott, Waynesboro, Pa., assigned to Landis Tool Co. Patent 1,993,854.

Ferrous Welding Electrode. Robert S. Johnston, Yardley, Pa., assigned to John A. Roebling's Sons Co. Patent 1,993,931.

Machine Tool Transmission and Control. Fred A. Parsons, Milwaukee, Wis., assigned to Kearney & Trecker Corp. Patent 1,994,253.

Scraping Fixture. Frank C. Linn, Swampscott, Mass., assigned to General Electric Co. Patent 1,994,316.

Processes

Art of Grinding. George W. Binns, Cincinnati, Ohio, assigned to Cincinnati Grinders, Inc. Patent 1,993,823.

Method of Making a Reamer. Robert W. Ellingham, Hampden Co., Mass., assigned to the Black & Decker Mfg. Co. Patent 1,993,879.

American Machinist
REFERENCE BOOK SHEET

Cutting Oils and Compounds

From the standpoint of composition there are five types of cutting oils. These are:

1. Lard oil.
2. Lard oil—mineral oil combinations, with or without sulphur.
3. Sulphurized mineral oils.
4. Mineral oils of straight composition.
5. Soluble oils and paste compounds.

Although lard oil gives excellent results in certain work, its extremely high price compared to other cutting fluids, and its other objectionable features have caused manufacturers to turn to other products. On the other hand, so far the use of low cost, straight mineral oils has proved successful only on the least severe types of operations. In the main, therefore, only three classes of cutting fluids are serving the economic and practical needs of industry. These are:

1. Lard oil—mineral oil combinations, with or without sulphur.
2. Sulphurized mineral oils.
3. Soluble oils and paste compounds.

It appears that the needs of industry can be met now by the latter two classes of cutting fluids.

Sulphurized Oils

Sulphurized mineral oils are being made in dark colored and light colored compositions, and their high sulphur content places them above the ordinary compounded oils in cutting efficiency. They are stable, non-irritating and will not develop rancidity. These oils are made in a number of viscosities for specific applications. The lightest bodied oil is for use on high-speed automatics where cooling is essential, and is most satisfactory on turning and other outside work. Its low viscosity gives it the faculty of passing over the tool and work quickly and draining away to dissipate the heat. Moreover, its low viscosity permits it to drain quickly from the finished pieces and chips, thereby decreasing consumption. This grade of cutting oil can be used also for the grinding of soft metals because its viscosity tends to give it the performance of water.

A slightly heavier sulphurized oil is satisfactory for general automatic work including drilling. A compounded oil of still greater viscosity is found necessary for general work, especially for milling, threading, gear cutting, tapping and turning. Light broaching can also be done with this material. The heaviest of the dark colored oils is required for the operations of broaching and heavy tapping and threading.

Occasionally the conditions of service demand the use of a light colored oil in order to provide visibility of the work. For this reason clear stable oils, having a large measure of the properties obtainable by sulphur incorporation, are available.

"Base" Oils

Some shops make use of a heavy product, highly compounded and sulphurized, for mixing with paraffin oil or engine oil. Oils of this type are called "base oils" and they provide a flexible means of varying the cutting oils for different operations. Difficulty in securing uniform mixtures may be experienced unless careful control is exercised in mixing in the shop.

To be satisfactory a soluble oil should form stable and practically permanent emulsions, and it should permit wide variations of concentration. Furthermore, it should provide good rust prevention to processed parts, and present no difficulty from gumming in machines or from skin irritation. Where washability is essential, the soluble paste compounds are employed. They are not as easily emulsified with water as the soluble oils, but mixing can be accomplished with hot water and steam. Paste compounds permit a ready means of securing the desired concentration. For example, for turning and ordinary machining it may be found that one pound of compound to two or three gallons of water will be satisfactory, and for grinding, one pound of compound to four or five gallons of water. On the other hand for difficult operations such as broaching, the paste can be mixed in the order of one pound of compound to three quarters of a gallon of water.

Some of the soluble oils and light cutting compounds can be used for light forming, stamping and drawing operations. However, heavy stamping and drawing of sheet metals, either in alloy or low-carbon steels, requires the use of paste compounds which may be thinned with water to the desired consistency. Moreover, where these products have been previously thinned with water, a soluble oil may be added to give a paste-like consistency for some particular operation. Thus, such a product can be used as a lubricant for severe punching operations. Compounding depends entirely on the class of work to be done. For average conditions the paste compound may be made from flowers of sulphur, but for more severe conditions, such as deep draws and sharp angles, where other lubricants are not satisfactory, a paste containing graphite may be necessary. Graphite compounds are removed with difficulty and should not be used unless necessary.

Die Lubricants

Scrap oils and greases or home-made mixtures are sometimes used by manufacturers for swabbing the dies in forging operations. These materials are poor lubricants for the conditions involved and give little protection to dies and tools when in contact with hot metal. For these reasons there have been developed forging die lubricants that can be applied to the die by means of a swab or brush and then further distributed by using an air jet. The material can also be applied by means of mechanical lubricators.

Experience has shown that the metal-working fluids should be selected to fit a particular need after a careful study of the specific job. Such materials are not expensive, but they can run up the costs of production if poorly chosen or improperly handled and controlled. They should be selected primarily for the work they will do, with other considerations secondary.

Courtesy of the Standard Oil Company of Indiana

How Shall We Get Skilled Men—Discussion

K. H. CRUMRINE

None will deny the need for a greater number of highly skilled men. So we become greatly concerned as to how we may get such men. Toward this end many worthy plans have been suggested, and many are, even now, in more or less successful operation. In devising and carrying out these plans, however, we have built our structure on foundations none too firm. We have assumed, first, that we have chosen young men capable of becoming the type of skilled men we need, and, second, that they themselves are sufficiently inclined to put forth the necessary effort to that end. We have for the most part overlooked the more important questions of how to attract a class of young men who are fitted to become highly skilled mechanics to our industry, and how to induce them to want to become the type of men we need.

Natural Inclination Necessary

To my mind, we must make it more worth while, in all ways, for a man to become a master craftsman in our field. A highly skilled mechanic cannot be made unless, as boy and man, he himself earnestly desires to become one, either through his natural inclination, or through his expectation that a reasonably successful and happy life will result therefrom.

There are, in our industry, many types and grades of skill, ranging from that of the operator who skillfully loads and unloads an automatic machine, to that of the highly capable mechanic who makes, and frequently designs, our tools, fixtures, and special apparatus, and does our experimental and development work. The man who only loads and unloads a machine may do this in a highly skillful manner, but his work can hardly be called a trade, nor do I believe that the type of skilled mechanic we so greatly need will ever be largely recruited from this group.

The type of man we need is a master craftsman in every sense of the term. He will have the equivalent of an ordinary high school education or better, although this may have been acquired by intelligent study and reading outside his working hours. He will have a knowledge of mathematics sufficient for his needs, and will have read a number of good books on mechanics, machine and tool designing. He will have some knowledge of drafting, and be able to discuss intelligently his work and the problems with which he deals. He will regularly read the best periodicals pertaining to his trade. He has acquired a good working knowledge of materials and the ordinary heat-treatment of metals.

In his work, as is to be expected, he exercises a high degree of manual skill, and, of equal importance, a similar degree of mental skill. He works safely and plans ahead. He makes use of time-saving short cuts and of methods and processes which enable him to secure his results in the easiest and most assured manner, rather than by the harder and more uncertain ways. He will have and use proper tools for his work, and these will be kept in suitable working condition. He will not leave burrs or sharp corners on his work, but neither will he remove these in a rough or slipshod manner. When he assembles working parts he will see that they are perfectly clean and properly lubricated. His percentage of spoiled work will be extremely small. He usually does not hurry unduly, but, rather, works in a carefully efficient manner. When occasion requires, however, he can work rapidly, and with reasonable assurance of satisfactory results.

Recognition of Craftmanship

In my opinion, neither this type of workman, nor the craft he typifies, has ever been accorded the recognition their worth deserved, either in suitable designation, or in reward. There should be, for such a craftsman, a distinctive name by which he should be honorably known, and standards should be set up the fulfilment of which would be the only way in which he could rightfully use this name, or receive the rewards attendant to it. The recognotion of its importance, and the more adequate payment of its members would attract a better grade of men, and make the craft of vastly more value to the industry. At one time the term "toolmaker" carried more or less significance, but even then the really capable men were not paid proportionately more than those of ordinary ability, and the name itself has largely lost its meaning.

Our desire for a greater number of skilled men is a selfish one. We want them because they save us supervisory effort, and because we believe they are profitable for us to employ. The more capable they are the more profitable they should be. They perform their work with little or no necessity for direction. They maintain and set our tools. They make our jigs and fixtures, and our tools, dies and gages, and they do our experimental and development work.

Many do not appreciate the possibility of saving time and money on such work. But if one stops to think he knows that these possibilities are almost unlimited, and that the price per hour of the really capable man becomes of small significance when considered in this light. The cost of work of this kind when done by men of ordinary ability can hardly be estimated.

Inducements Needed

Not everyone can become a really capable mechanic, and even by those who can, the skill and knowledge expected can only be acquired through years of experience. Since there has been no promise of any particular reward for attaining high proficiency in the trade, comparatively few have deliberately planned at an early age to spend the time and make the sacrifices necessary to become skilled in the mechanic's art, as they would in some other more desirable art or profession. We must, therefore, not only provide the facilities which make it possible for a young man to advance in the craft, but we must set up the inducements which will cause him to earnestly desire to attain a high proficiency in it.

High mental qualifications are desirable, as well as skill of hand and eye. In fact, the man we are discussing might well have been a dentist, an optician or a watchmaker, any of which would be expected to provide much greater rewards. Consequently many young men who might have made the very best mechanics have not been attracted to our trade. Again, many who have attained to only ordinary ability are really capable of becoming highly skilled, if there were any particular reason why they should. They, however, already receive the so called "top rate" and could not get any more even if they were much more capable. The old-

time pride in doing a job in a really workmanlike manner has largely disappeared and not without reason.

Let us have our trade schools and apprenticeships. Let the older men train the younger. Let us use what means we will to start the younger mechanics in the right direction. But all will fail of the desired results unless we instill in them the will and intense desire to attain the highest skill, and unless they lead with reasonable assurance to something worth while, and not to just a precarious means of securing a very modest living. Let us, therefore, make the title of master mechanic of the recognized importance which it once enjoyed, and raise it to the higher plane which its importance rightfully deserves.

Choosing the Right Machine for the Job

JOHN A. HONEGGER

Unfortunately some executives are not as well posted as they might be on the best types of equipment for certain jobs.

As as example, a well-known concern had to make a quantity of elliptical parts to fairly close limits. It was at first proposed to use a profiling machine, but the production engineer did not believe that a machine of that type could turn out the job within the limits specified, which were plus or minus 0.002 in. The writer endeavored to point out that profiling machines were used in gun and sewing machine plants to turn out parts of irregular shape having closer limits. Since the production engineer could not be convinced, the writer left the matter in his hands for a few day's consideration.

Upon the writer's return to the plant after a few days, imagine his surprise to find that the powers that be had decided to buy a medium-priced lathe, remove the cross-feed screw, put several brackets on the back of the bed, run an auxiliary shaft from the back gears, attach a master cam and a counterweight, mount a toolpost grinder on the toolblock, and thus generate the shape of the ellipse by grinding; all at the cost of several thousand dollars.

The writer went to the catalog file and took out the catalogue of a well-known maker of grinding machines. Turning to the accessory pages, he pointed to a cam-grinding attachment which, when attached to a grinding machine of the same make, would do the required job in less time and at less cost than would the improvised arrangement decided upon. This attachment could be bought for about $300. Here was an organization the personnel of which was supposed to be on its toes and to be intimately acquainted with the most efficient equipment, yet did not know about this attachment, which had been on the market for more than ten years.

In these days of curtailed purchasing power, shorter hours and increased wages, competition is becoming keener among all industrial groups. The group that keeps abreast of all improvements in equipment and methods will far outdistance the one that does not. Therefore, it behooves every executive responsible for production to become acquainted with existing equipment of all kinds. This can be easily done by studying the various advertisements and the pictured set-ups in technical magazines and catalogs. The amount of valuable information to be found therein is surprising.

Then there are the new-equipment sections of technical magazines which describe the operation of various new equipment and accessories in considerable detail. A survey of these sections will greatly add to one's knowledge. Whenever I pick up a technical magazine, I invariably glance through the new-equipment section before reading the editorial matter. Because of having done this I have been able to recommend equipment that has saved many dollars.

Polishing and Buffing Costs—Discussion

JOHN E. HYLER

Referring to the article by K. M. Singer (*AM*—Vol. 79, page 180) criticizing my article under the title given above (*AM*—Vol. 78, page 641), if I remember correctly the statement was made in my article that on some types of products, costs of polishing were almost negligible, while on others they would be exceptionally high. After questioning the accuracy of this statement Mr. Singer proceeds to make practically the same statement himself by saying, "Certainly there are articles the finishing cost of which must be very high, etc."

I do not question the value of his experience as an apprentice in both engineering and production shops, nor that of his experience as a trainer of polishers, but I feel that perhaps he read my article a little too hastily.

As to much polishing being done on automatic machines, that is not a prophecy altogether; it is largely a present actuality. Regardless of Mr. Singer's contention that the design of automatic polishing machines is extremely difficult and seldom justified, such machines have not only been designed, but have been made and used. One such machine is of the rotary table type and the motion of the table can be either continuous or of the indexing and dwelling type. A reciprocating movement can also be incorporated. It can handle rounded, beveled or flat work.

A machine of the turret type is used for such parts as piston pins and valve stems, the turret indexing and unloading automatically while the operator loads it as it turns. Then there is the conveyor-type automatic buffing and polishing machine, which is built in different designs. One, designed for screw and bolt work particularly, is self-contained and has three wheels under which the work is carried in turn. Then there is the other type mentioned in my previous article, in which a number (any reasonable number desired) of wheel units are arranged in series, and conveyor mechanism of suitable length and design is fitted. Planer blades, builder's hardware, pliers, sewing machine parts and what have you, are finished on machines of the nature described.

It is not contended that any of the machines mentioned can be set into any shop and a real advantage be realized. Such a contention was not a part of my first article, but it is honestly believed that there are many types of products to which some of the machines mentioned can be made fully adaptable, and even that there are many to which they have already been adapted. Obviously, with this as with so many different types of modern equipment on items to which they can be applied, the manufacturer of such items can not compete with others in the same line without installing it.

IDEAS

FROM • PRACTICAL • MEN

Three Bends in One Operation

PETER L. BUDWITZ

We had to bend a large quantity of parts as at *A*, Fig. 1, the blanks for which were cut off and notched, as at *C*, in a separate operation in conventional tools. The material was strip brass 0.030 in. thick.

The bending tools are illustrated in Fig. 2. In operation, a blank is placed on the combination pressure pad and ejector *A*, being guided by the shoulder *B* on the die. As the ram descends, the bending punch holds the work tightly on the pressure pad and pushes it and the pad down into the slot in the die, making the longitudinal bend.

As the ram continues downward, and before the springs of the pressure pad are fully compressed, the angular surfaces of bending members *C*, attached to each side of the punch plate, contact with pins *D*, causing the members to swing outward and bend the projecting ends of the work, as at *B*, Fig. 1. The bending members *C* pivot on screws *F* and are backed by the punch plate *H*, the side thrust being taken by screws and washers at *J*. These screws pass through curved slots in the bending members and permit them to swivel on screws *F* as centers. When the ram is at the lowest point of its travel the bending is completed.

As the ram ascends, the ejector forces the work upward and out of the die and the flat spring *K* pushes the bending members *C* back to the starting position. The action of the tools is so timed that the longitudinal bend is completed before the end bends are started.

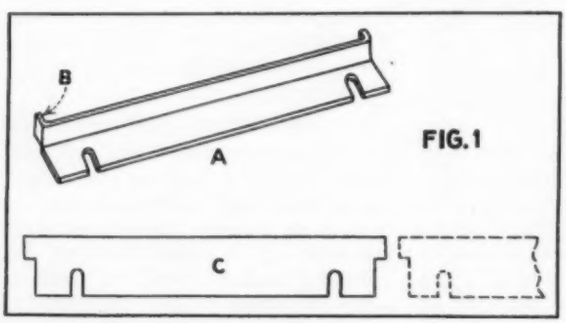


Fig. 1—The blank and a finished part. The blanks are cut off from strip brass 0.030 in. thick and are notched in a separate operation

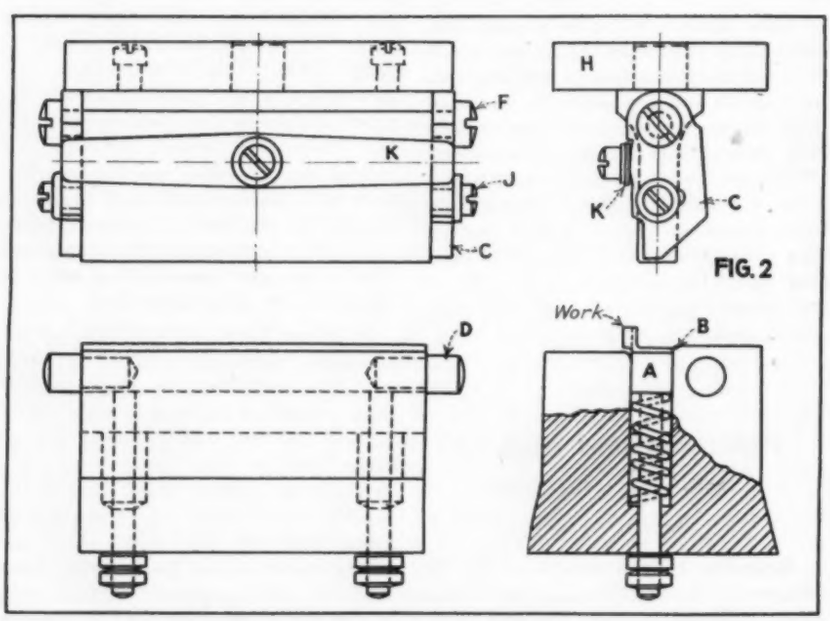


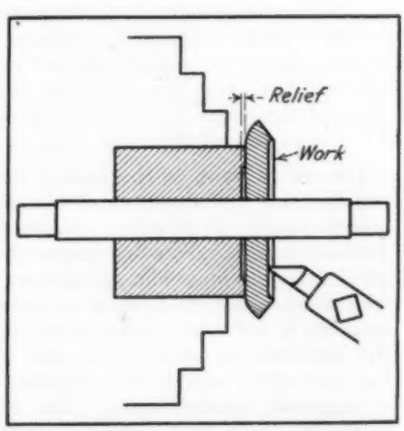
Fig. 2—Just after the longitudinal bend has been completed, and while the ram is still descending, bending members *C*, swiveling on screws in the punch plate, are forced outward and bend the ends

Facing and Turning Thin Work

LEONHARD ENZINGER

Facing and turning washers, disks and other thin work sometimes presents a real problem to the lathe hand, especially when the material is just thick enough to clean up, and when the hole is very short compared with its diameter.

The illustration shows an inexpensive method for cases where work has been faced on one side at the time of boring the hole. A piece of round steel of about the same diameter as that of the work and from three to four times as long as the thickness of the work is mounted in the chuck. The piece is faced and a hole is drilled, bored and reamed to the same diameter as that of the hole in the work. This hole should run true at all points.



Thin work faced on one side and mounted as shown can be faced true with the finished side in either the lathe or the grinder

Then the face of the piece is relieved about 1/32 in. as shown, leaving a narrow ring for the finished side of the work to bear against.

The semi-finished work is slipped on a mandrel and the mandrel is inserted in the hole of the piece in the chuck and is set tight by a few blows from a soft hammer, or better still, is pressed in by the tailstock spindle of the lathe. This also tightens the work on the mandrel and at the same time draws the finished side against the ring referred to. The work can then be faced and the outside turned. The mandrel can readily be removed by a knockout rod inserted through the hole in the spindle.

This method of mounting work is also applicable to grinding. In this case it is often advisable to use a soft mandrel and to relieve it flush with the work, thus permitting the grinding wheel to pass over the full face. The hole in the steel piece should, of course, be finished by grinding.

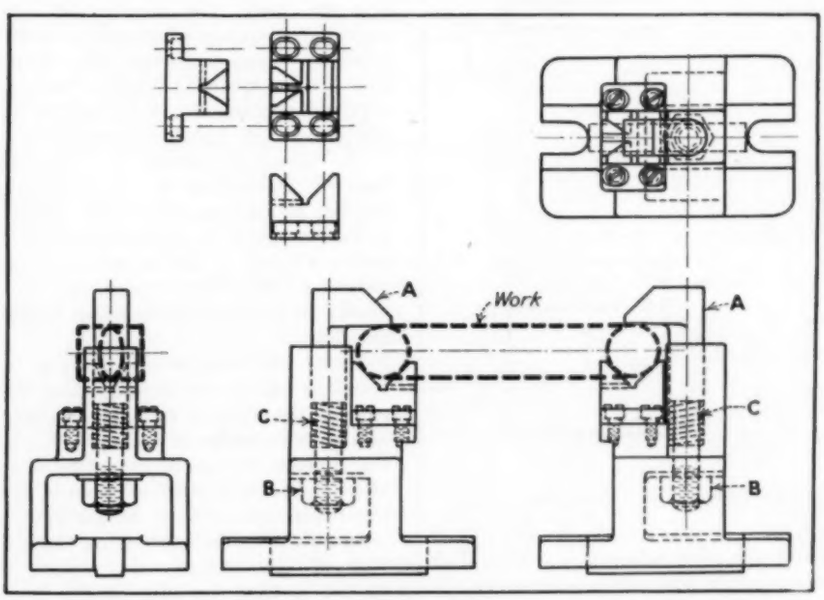
Fixture for Straddle Milling

C. W. PUTNAM

The fixture illustrated is for use in machining the bosses on the ends of valve-rod links by straddle milling.

The bosses of the links are held in V-blocks and are clamped by the hook clamps *A*, which are threaded on their lower ends and are operated by the nuts *B*. Stiff springs at *C* raise the clamps clear of the work when the clamping pressure is released.

Due to slight variations in the length of the work, adjustment is provided in the V-block at the right by elongating the holes for the shoulder screws that hold it to the base casting. These screws hold the V-block just tight enough to permit it to adjust itself automatically when clamping that end of the work.



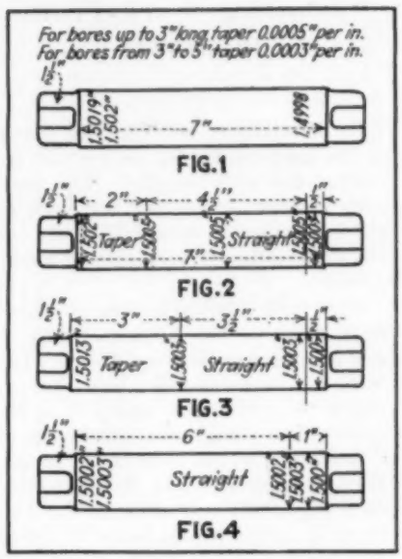
The bosses at the ends of valve-rod links are straddle milled in this fixture. One V-block is adjustable to take care of slight variations in the length of the work

Common Sense in Mandrels

HECTOR J. CHAMBERLAND

Mandrels having the conventional taper of 0.0005 in. per in. should not be taken as standard. It is safe to say that the constantly increasing demand for utmost precision, whether holes are bored, reamed or ground, will eventually require mandrels of a different taper, the taper to be governed by the length of the bore.

From my experience, the assortment of mandrels to be found in most toolcribs is not only incomplete but is in worse condition than anything else in the outfit. There are generally not enough mandrels to accommodate the needs, and their tapers are not proportioned by the law of common sense, being universal rather than special. The accompanying illustration shows 1½-in. mandrels that are my idea of what is common sense in their proportions.



Mandrels having the conventional taper of 0.0005 in. per in. are not in line with present-day requirements as related to precision work

The mandrel in Fig. 1 is for work having a reamed hole over 3 in. and not over 5 in. in length. The one in Fig. 2 is for work having a reamed hole over 5 in. in length. The one in Fig. 3 is for work having a hole finished by grinding, irrespective of its length. The one in Fig. 4 is intended for testing the bores of finished parts to locate any possible error. Mandrels finished to the dimensions given will retain their efficiency from every angle.

There is more reason today than ever before to cut down on the conventional taper. A substantially long bushing or sleeve turned on a mandrel having excessive taper will not check up straight, concentric or to size externally when removed. If the wall is not thick enough to resist expansion by being driven on the mandrel, the outside will not be parallel, and the error will vary with the nature of the material.

In using a mandrel having a practical taper, the only thing to worry about is its accuracy of size. If worn below size it can be repeatedly brought back to its original dimensions by chromium plating, and at a fraction of its original cost. It seems strange that so few shops have installed equipment for chromium plating. I believe that many executives do not quite realize what it is all about, while with some it is probably ignorance of the wide range of usefulness of the process. Others are so imbued with antique ideas that they do not want to learn.

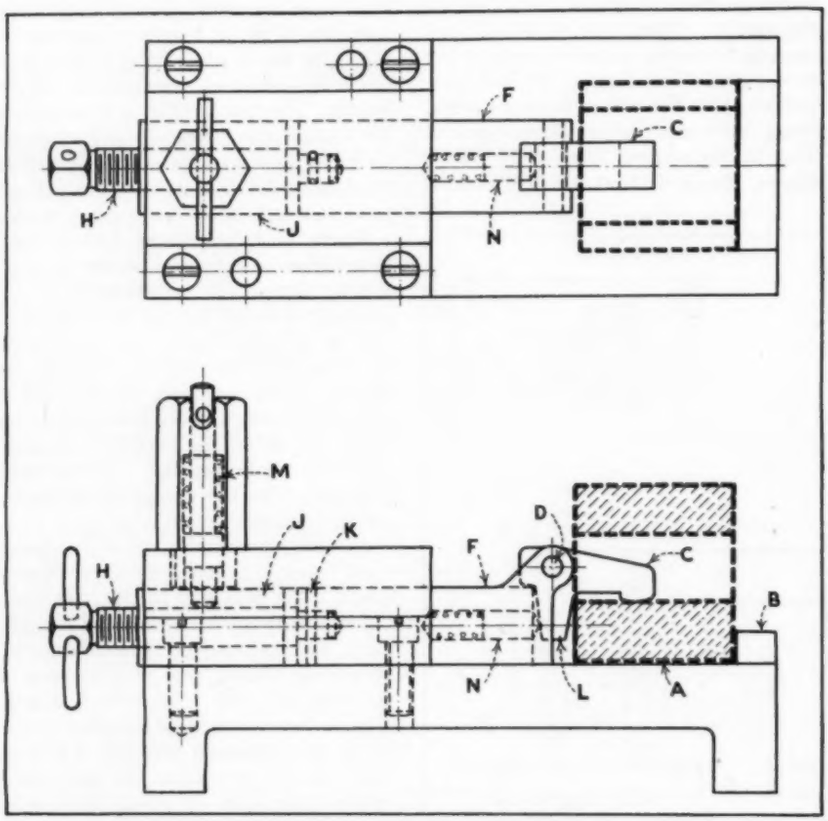
Clamping Work From the Inside

F. SERVER

In the clamping arrangement shown means are provided for placing and removing the work quickly. The complete method of locating the work in the fixture is not shown, since the interesting feature is the clamping mechanism.

The work, shown in heavy dotted lines, rests on the finished surface *A* and is pushed against the stop *B*. The work has a rectangular hole through which the toe of the clamp *C* is entered. The clamp is in the shape of a bell-crank and is pivoted on the pin *D*, by means of which it is mounted on a lug at the end of block *F*. This block is moved by the screw *H* acting in a tapped hole in block *J*. A small pin *K*, in block *F*, engages a circular groove in the end of screw *H* and ties the screw and the block together.

When the screw *H* is turned and the tail *L* of the clamp contacts with the work, further tightening of the screw causes the work to be pushed against the stop *B* and then to be gripped by the toe of the clamp. In removing the work, the spring pin *M* is raised, disengaging its lower end from a hole in block *J* and permitting that block and block *F* to be moved to the left by pulling on the cross-handle of the screw. As the blocks slide to the left, the spring pin *N* pushes on the tail of the clamp and raises the toe clear of the work. When a new piece of work is put in the fixture, the screw and both blocks are pushed in and spring pin *M* snaps into the hole in block *J*. Tightening the screw pushes the work against the stop and causes the toe of the clamp to grip the work, as explained above.

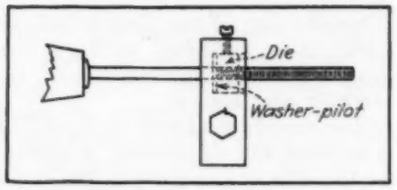


By pushing in the sliding blocks and tightening the operating screw, the work is first pushed against a stop and is then clamped

Insuring Accuracy of Lead in Die-Cut Screws

MALCOLM K. PARKHURST

When threading work with a button die or a die of similar type, the resultant thread is generally not of accurate lead and causes a binding action in the nut. This is especially true if the nut is very long. Occasionally the discrepancy of lead between the screw and the nut is so great as to prevent their being used together. This trouble



Since the die is fed along the work by the lead screw, the lead of the resulting thread will be as accurate as that of the lead screw

can be prevented by feeding the die by the lead screw.

Referring to the illustration, the arrangement consists of an inexpensive bar or block clamped on top of the toolblock to hold the die, and a washer of the same outside diameter as that of the die and the same inside diameter as that of the outside of the screw. The washer is placed in the dieholder ahead of the die and materially assists in centering the die.

The feed of the carriage is set to correspond with the lead of the screw to be cut. Thus the die has no other function than to cut the threads on the screw, the lead being taken care of by the lead screw. Therefore, the lead of the screw will be as accurate as that of the lead screw.

Simple Fixture for Testing Squares

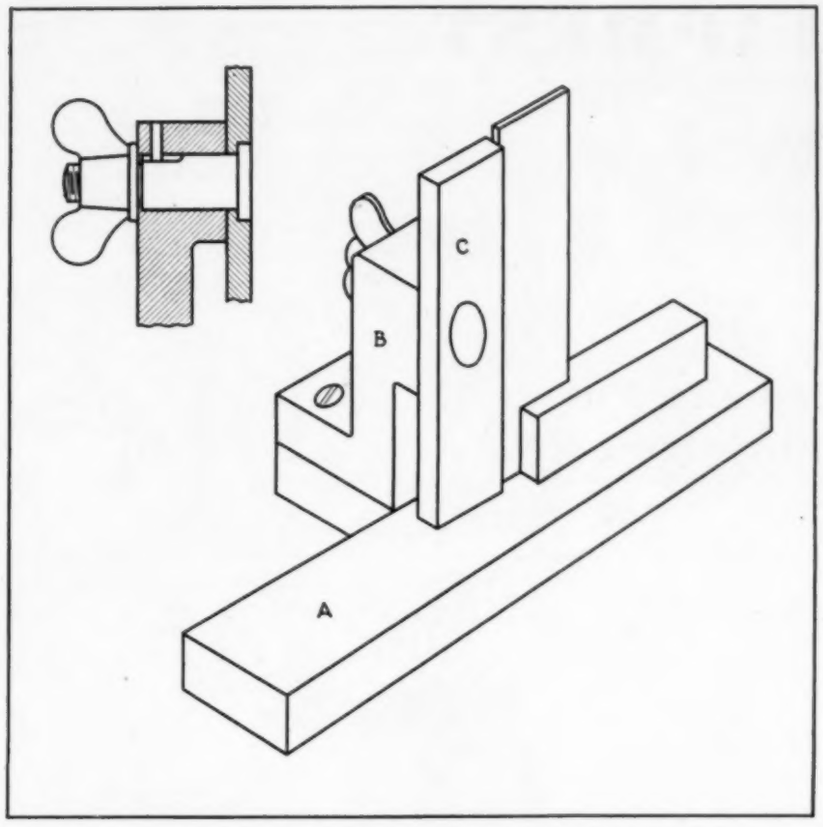
FRED B. JACOBS

In every machine shop devoted to accurate work, the question of the accuracy of squares often arises. There is always some workman who claims that his pet square is "square." However, all arguments can be settled by the use of the fixture illustrated.

The device consists of the cast-iron base *A* to which is attached the bracket *B;* and the adjustable upright *C* held in place by a shouldered stud and a wing-nut. The base is scraped accurately flat. The upright is steel, hardened, ground and the edges lapped parallel.

In use, the beam of the square to be tested is placed on the base and the edge of the blade is brought into contact with one edge of the upright. In this position the upright is adjusted so as to shut out all light between it and the blade, and is then locked by the wing-nut. Without disturbing the setting of the upright, the square is moved so that the edge of the blade is in contact with the opposite edge of the upright.

If no light shows between the edge



If squares are tested in this fixture by the described method any argument as to their accuracy can be definitely settled

of the square and the edge of the upright, the square is accurate. However, if light shows through at the top, the angle of the square is less than 90 deg. If light shows through at the bottom, the angle of the square is greater than 90 deg. In either case the error shown is double the actual error of the square.

A Problem in Dimensions Discussion

PAUL C. BRUHL

In criticising my discussion of his article under the title given above, L. Kasper says (*AM*—Vol. 78, page 772) that I have overlooked the fact that it is impossible to determine just where to start the angular cut for the bore until the angular groove has been cut, and that my suggestion will not serve the purpose.

Notwithstanding Mr. Kasper's assertion to the contrary, the position for starting the angular cut for the bore can be found before cutting the angular groove, since all necessary dimensions, including the two radii, are given. Suppose the ring were to be machined without the angular groove, how could it be found just where to start the cut for the angular bore? There are several solutions. Considering an analytical method where the ring is to be machined as in Fig. 1; to find diameter *X* of the bore, which will later be enlarged to diameter *A* when the small radius is machined; multiply the small radius by the cotangent of the angle of the bore, subtract the radius from the product and multiply the remainder by two. By subtracting this product from dimension *A*, dimension *X* will be found.

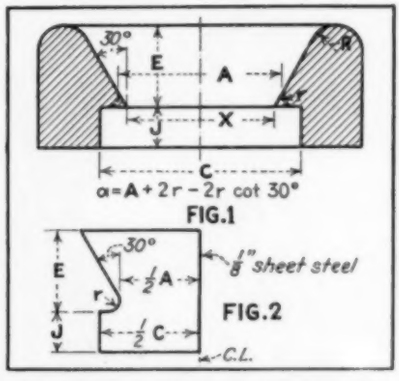


Fig. 1—Just where to start the cut for the angular bore can be determined by the formula given. Fig. 2—As an alternative, this templet can be used in connection with the cut and try method

By machining the small end of the angular bore to dimension *X* and machining the small radius until dimension *A* is arrived at, the angular cut for the bore can be correctly started, permitting the use of the method suggested by me (*AM*—Vol. 78, page 681) for placing the angular groove.

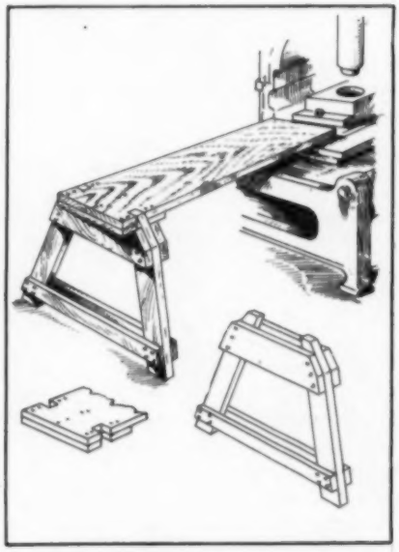
Using an empirical method to machine the angular bore correctly, a templet, as in Fig. 2, could be made, and by the cut and try method the angular bore and the small radius could be machined to the templet until dimension *A* was arrived at. Then the angular groove could be located as suggested by me. To compare other reference letters see *AM*—Vol. 78, page 516.

Feed Board for Strip Stock

CHARLES H. WILLEY

In making stampings from long strip stock it is very convenient to have a table or board on which to lay the strip, especially at the start.

The sketch shows a feed board that we designed for our own use. It is made of hardwood and is put together with screws. Its features are that it can be taken down for storage when not in use, can be quickly assembled when wanted and that it can be cheaply made by the maintenance man.



A feed board of this type is quite a convenience around the press when stampings are to be made from long strip stock

SHOP EQUIPMENT NEWS

Ajax Solid-Frame Forging Presses and Wide-Adjustment Forging Rolls

Two lines of machines are being introduced by the Ajax Mfg. Co., Euclid Branch P. O., Cleveland, Ohio. The line of "Solid-Frame" forging presses illustrated in Fig. 1, ranges in capacity from 500 to 1,800 tons. These high-duty, fast-operating machines are designed for accurate forging work and precision hot or cold coining of forgings. The second line of machines is that of "Wide-Adjustment" forging rolls to replace earlier models.

The forging presses are controlled by a pneumatic clutch of the same type as used on the company's horizontal-type forging machines. A piston carried within the flywheel applies pressure directly to the friction plates and gives instantaneous but cushioned response to tripping. This action is accomplished by a small auxiliary foot- or hand-controlled air valve. By regulating the air pressure at the clutch the torque capacity is definitely limited to provide an effective safety for the press and dies. The clutch will operate at high speed, permitting the press to operate at speeds as much as 50 per cent above normal for presses of corresponding size.

The frame is a solid one-piece steel casting of heavy cross-section to provide rigidity. The rigidity obtained by this construction improves the uniformity of the work produced, increases the die life.

The main shaft is of the full-eccentric type and is made of a heat-treated, special-analysis steel forging. Bearings are of the adjustable, split-sleeve type with shimming at the part-line and a wedge beneath for adjusting to the proper running fit. The main gear that drives the eccentric shaft is of built-up welded-steel construction with a high-carbon, wear-resisting rim for the teeth. In the 1,800 ton size two stage gearing is employed, the high-speed stage consisting of herringbone gears operating in a bath of oil.

The ram, Fig. 2, derives improved alignment from a top extension bearing at the rear side of the crown rib. Thus, unusual guide length is secured without increasing the length of the frame. The ram is designed to withstand loads off center such as developed in multi-stage dies with the fullering, roughing, finishing and trimming impressions sometimes required for economical production of forgings. The slide is guided front-to-back against off-center loads and pitman angularity by means of tongues at the rear, which are not subjected to line contact by bowing of the cover-plate and can be fitted to close limits despite the expansion of the ram from hot working. A wedge side-guide provides for maintaining accurate side alignment with minimum running clearance.

The pitman, as shown in Fig. 2, is cut from special-analysis, rolled-steel plate, heat-treated, and the main bearing is accessible for assembly, inspection and adjustment. To keep down unit pressures the wrist pin bearing is

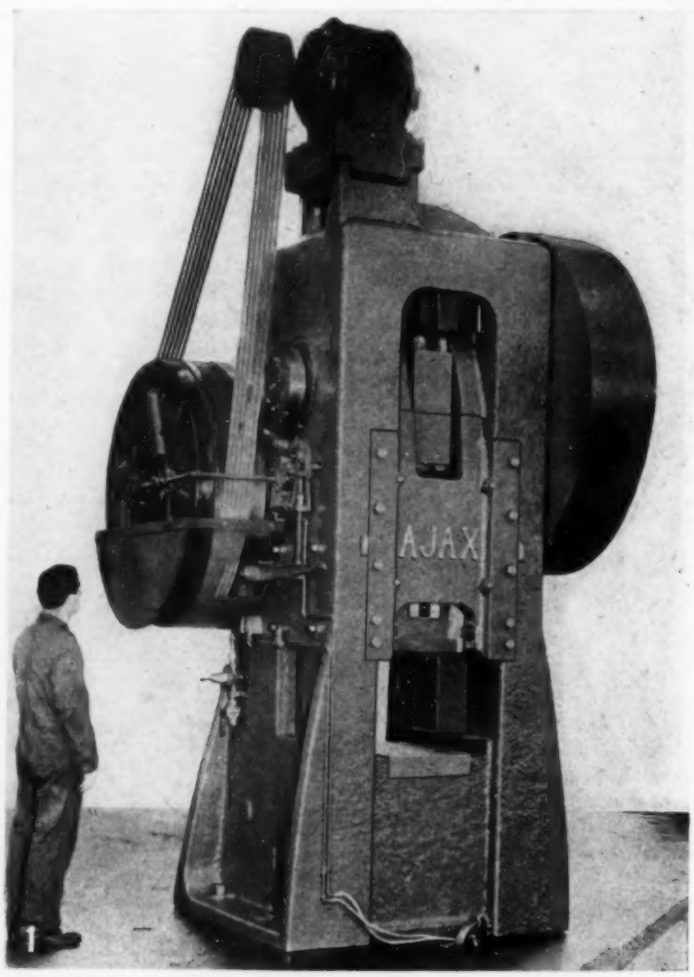
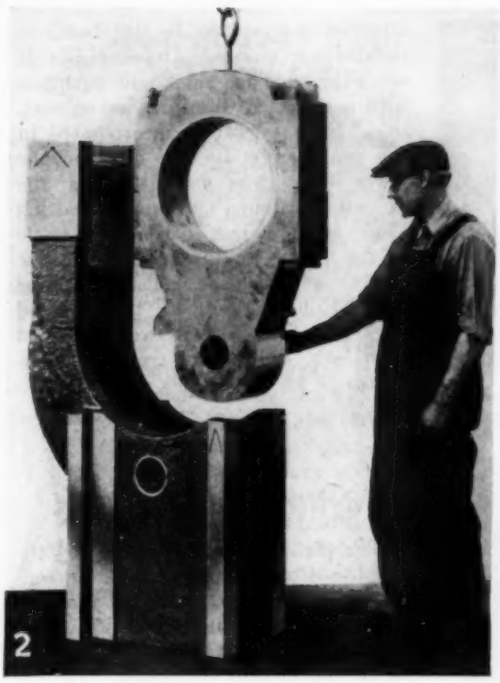


Fig. 1—Front view of Ajax Solid-Frame Forging Press which is air-clutch operated. The frame is a one-piece steel casting and the distance from the crankshaft to the die seat is comparatively short



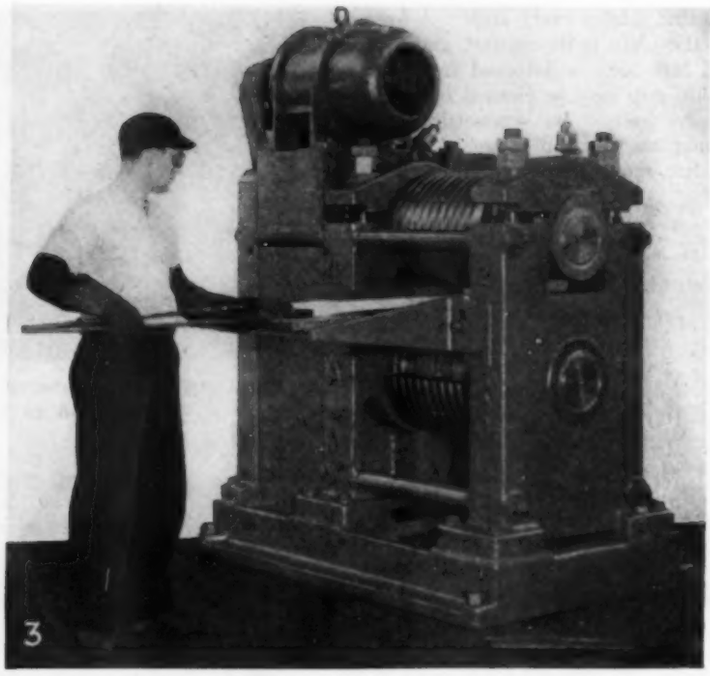


Fig. 2—The ram of the Ajax Forging Press derives improved alignment from a top extension bearing at the rear side of the crown rib. The pitman is cut from rolled steel plate. Fig. 3—Ajax "Wide Adjustment" Forging Rolls which are built in three sizes. The "wide adjustment" between the semi-cylindrical dies makes possible a greater number of die re-dressings

supplemented by a thrust shoe bearing for its outside surface, and this bearing is sealed and individually lubricated.

A wedge in the bottom die seat provides for fine die adjustments without shimming, and is installed in such a manner as not to interfere with the removal of forgings by way of the back of the press. Side wedges and front-to-back poppets facilitate shifting the bottom die in either direction to secure proper matching with the top impressions. A central knock-out in the ram is mechanically operated as well as the multiple knock-out in the die seat. The latter has nine stations for ejecting difficult pieces from dies with progressive impressions.

Individual drive is obtained through multiple V-belts from a motor mounted on an adjustable hinged bracket at the top of the frame. A hand brake may be used to stop the flywheel from coasting after the power has been shut off to save time in making die adjustments. All sizes of presses are equipped as standard with an automatic centralized lubricating system. A pneumatic ram counter-balance is also included.

The "Wide Adjustment" forging rolls, shown in Fig. 3, are made in three sizes. Rolls of the "O" or smallest size are used in automotive plants for tapering the ends of spring leaves and pointing coil springs, while the larger Nos. 1 and 2 sizes are used for forging gear-shift levers, rear-axle drive shafts and similar parts, and for fullering and drawing operations on stock prior to drop or upset forging.

As the name implies, these rolls are characterized by "wide adjustment" between the semi-cylindrical dies in which the forging impressions are sunk. This construction makes possible a greater number of die re-dressings and results in longer die life and decreased maintenance. It is accomplished through an unusual gearing arrangement wherein the meshing of the roll gears is not disturbed by the 2¼ to 4 in. adjustment provided, as contrasted with the old arrangement with ⅜ to ¾ in. adjustment. Previously, long-toothed roll pinions were moved into and out of proper mesh, resulting in joggy operation and excessive back-lash. There is also a lead adjustment on the top roll die to bring intricate or shouldered impressions into perfect match.

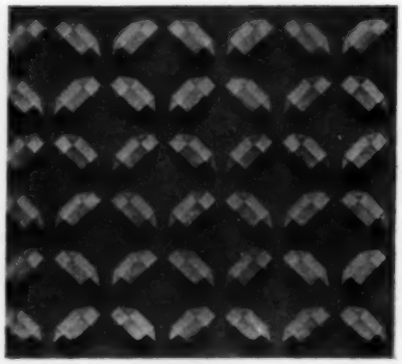
The top roll housings are adjustable vertically for proper forging thickness and are, like the main housings, steel castings with large cross-sectional area. These housings have provisions for taking up end play on the roll shafts, thereby preventing transverse mismatching of the dies. The roll shafts have integral die holders in which the die screws are so located as to make possible the use of half-width dies.

The gearing is completely housed and guarded to protect it from scale. Plain bearings on all shafts are grease lubricated, and those on the roll shafts are fitted with constant-feed pressure cups. Drive is from an individual motor mounted on an adjustable hinged bracket above the gearing, and is taken through V-belts to the flywheel. The larger sizes can be equipped for stop motion operation with the Ajax air clutch and co-acting brake, such as employed on the company's air clutch forging machines. This places the operation of the rolls entirely under the control of the operator, making it possible to use dies with intricate impressions and thus increasing the variety of pieces that can be roll forged.

Illinois Multi-Grip Floor Plate

Multi-grip floor plate has been announced by the Illinois Steel Company, 208 South LaSalle St., Chicago, Ill. The design of the plate has been developed to assure high degree of skid

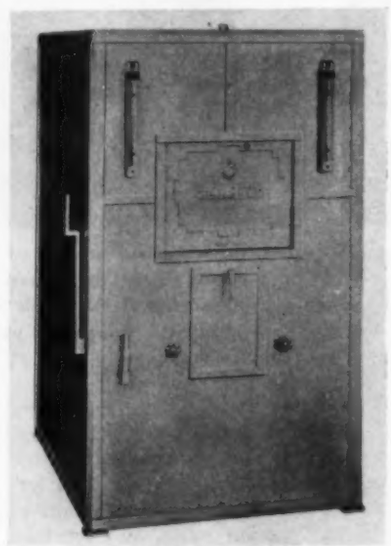
resistance from every angle. A feature of the plate is its comfort under foot. All lugs have a flattened top surface. Multi-grip may be cleaned readily and drains freely. Its symmetrical design minimizes waste in cutting. The illustration shows the lugs slightly reduced.



"Multigrip" Floor Plate comes in thicknesses from 3/16 to 1/2 in.

Hevi-Duty High-Temperature Industrial Furnaces

A line of furnaces operating up to 2,300 deg. F. has been developed by the Hevi-Duty Electric Co., Milwaukee, Wis., through the use of an improved metallic resistor element. This element can be operated in either oxidizing or reducing atmospheres. Breakdown tests with furnaces in actual operation indicate an element life, when using the improved wire at 2,300 deg. F., comparable to normal expectancy of nickel-chromium operating at 1,850 deg. F. The wire has a resistance 45 per cent greater than nickel-chromium and a higher current carrying capacity which makes possible ample kilowatt capacity to handle the increased temperature requirements. No water cooling of the element terminals is required. Elements can readily be welded. The furnace is equipped with the Hayes "gas curtain" atmospheric control feature for providing either oxidizing or reducing atmospheres for the charge being treated. The protective atmosphere for the charge can be introduced direct to the furnace chamber without deteriorating the elements. The installed capacity is 21 kw. for operation on 230 volts. The furnace will heat from room temperature to 2,300 deg. F. in one hour and 35 min. The heating element design is adaptable to many kinds of furnace types to suit various process requirements.



Heating to 2,350 deg. F. is accomplished in 1 hr., 35 min.

Hamilton "Steelwood" Drafting Tables

The "Steelwood" drafting tables, introduced by the Hamilton Manufacturing Co., Two Rivers, Wis., are being offered in three sizes, with a variety of drawer combinations to meet drafting room requirements. The frame is of welded steel construction. Drawer units are of wood, while the drawers themselves have steel fronts finished in olive green. A new standard height of 37 in. has been incorporated in their construction. Cadmium plated steel end cleats are attached to accommodate the Hamilton parallel-rule device. Drawing boards are adjustable for slant and equipped with a standard tilting device on each side. Special features incorporated in the construction include bolts on the lower front legs for attaching the Hamilton-Calumet coaster drafting chair, and foot rest with a brass angle on the front edge to prevent wear. The drawer arrangement consists of one large shallow drawer for tracings and papers, and a tool drawer equipped with lock, sliding tool tray and compartment for ink bottles.

Udylite Plating Barrel

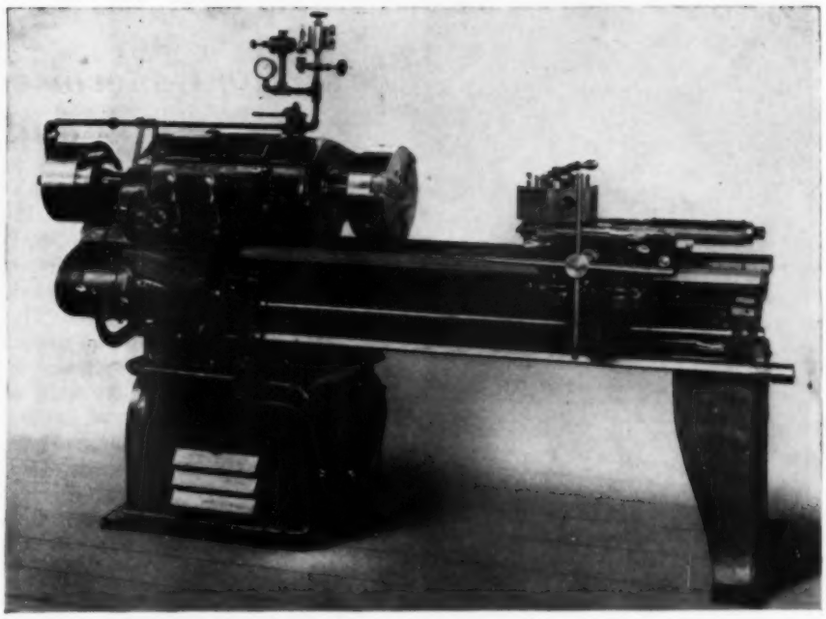
Udylite Plating Barrel

The plating barrel developed by the Udylite Co., Detroit, Mich., is constructed of steel and shock resistant rubber. The cylinder consists of a frame work of steel into which are fitted rubber rails and heads. The entire steel frame work is anodically charged so that it does not plate. In the Udylite barrel, there is no treeing. All of the current goes direct to the work because of the following reasons: the cathode lead is incased in unbroken insulation from contact pins to dangler arbor; the cast-iron hanger from which the cylinder is suspended is not integral with or a part of the cathode lead, therefore, strains in the hanger have no effect on the lead, and do not cause its covering to crack; the bearing on which the cylinder revolves is anodic and separate from the cathode lead; and the rails are of solid rubber and do not incase either a cathode lead or steel reinforcement.

Cylinder heads are of heavy rubber. Steel end plates reinforce the rubber heads of the cylinder. Stay-bolts, bolted through rubber heads and steel plates, hold the cylinder firmly together. The cylinder rotates on self-aligning bearings located at both ends. The contact arbor shank is heavily chromium plated to facilitate cleaning. Three danglers on the arbor insure ample supply of current. A thermo-controlled pushbutton switch guards the motor against overloading or single-phasing. Heating and cooling coils are held in a welded steel tank. Pins fastened to the yoke connect the cathode bus bar with the cathode lead and support cylinder firmly in saddles at four points, two on each side of the tank. Power is supplied by a ½-hp. motor. A speed latch ensures positive contact, and a flick of the finger operates it. Pinion gears are hardened and ground.

Reed-Prentice 8-Speed Turret Lathe

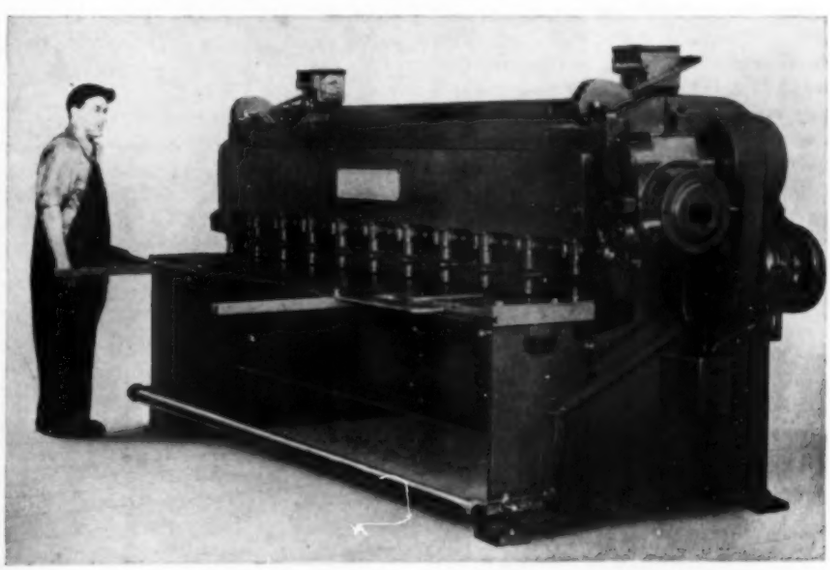
The Reed-Prentice Corp., Worcester, Mass., has developed the 14 in., sliding-gear head production type turret lathe illustrated. This machine is similar to the company's standard sliding-gear head engine lathe, except for the turret construction. Design incorporates an eight-speed sliding-gear headstock with self-contained motor drive and quick-change mechanism for feeds only. The machine is equipped with power-feed bed turret, which includes both forward and reverse feeds for drilling and reaming in cast iron mostly. A 12-in., three-jaw combination air chuck, operated through a 10-in. double acting cylinder, holds the work. Specifications: Speed range 18 to 432 r.p.m.; feed range, 0.0035 to 0.112 in.; swing over bed, 14½ in.; floor space, 8x3x4 ft., and weight, 2,450 lb.



To improve the finish of drilled and reamed holes, the power feed turret can be operated in both directions

Cincinnati Shear for 10-Gage Material

The Cincinnati Shaper Co., Cincinnati, Ohio, has added to its line of all-steel shears a smaller series of machines than heretofore built, with capacity for shearing 10-gage steel in 8, 10 and 12 ft. lengths. The main frame, table and crosshead are made of heavy rolled steel plate. Hydraulic hold-downs, with plungers spaced at 12 in. centers develop a pressure of approximately 2,000 lb. each. The five-jaw clutch is totally inclosed and runs under oil. In addition, a friction slip or clutch is provided for the fly-wheel rim as overload protection. The characteristic features of this shear are the low rake of the knives, ⅞ in. to the foot, the four-edge solid knives, and a speed of 60 strokes a minute. This shear is regularly furnished with a 6-in. throat in the housings. A slitting gage is available which permits the cutting of long shapes on a short shear in two or more operations. Three button control to the motor is provided, the third being an inching button for operation of the shear when setting the knives. The electric lights are so placed and focused that they afford a means of shearing to a scribed line. All that is necessary is to place this line on the bright edge of the light beam, thus avoiding the difficulty of sighting the position of the sheet from the end of the shear. Standard equipment includes a knife guard, automatic lubricating system, front gage and back gage.



Square-D Trolley-Square-Duct

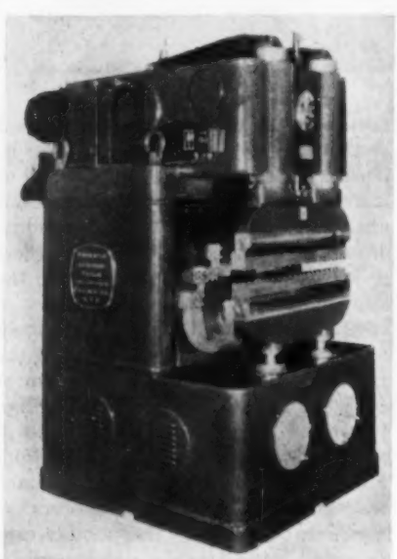
A system for providing mobile electric circuits for portable tools, so that the work can be followed along conveyors and assembly lines without the use of long, unwieldy and dangerous cords and cables, has been introduced by the Switch & Panel Division, Square D Company, Detroit, Mich. Known as the "trolley-square-duct," the system consists of an almost entirely closed duct containing stationary busses, along which travels a carriage or trolley. Collector wheels of the trolley transmit the current by means of wires connected to the tools. One type of duct section has a "gage" which can be pushed back, permitting the removal or insertion of a trolley. Curved sections are also manufactured to meet building or manufacturing requirements. Feeders or sub-feeders can be brought into the system at any point by means of special connection boxes, which should not interfere with the operation of the trolley. Any number of trolleys can be operated on a system, the ducts supporting at least five trolleys per 10-ft. section, with tools. Other applications include supplying current to small traveling hoists, feeding motors of machines on which the motors are mounted on a traveling bed, and for

Any number of trolleys can be operated on the Square D Duct System

portable tools used in various parts of the building or departments where long electric cords or cables form an inconvenience or hazard.

"American" 600-Kva. Projection Welder

The 600 kva. projection welder built by the American Electric Fusion Corp., 2610 Diversey Ave., Chicago, Ill., is fabricated entirely from steel plate by arc welding. The machine weighs in excess of 14,000 lb., has a base 52x52 in., and is 88 in. high. It is capable of welding simultaneously 20 spots distributed over a space of 36 in. in length. Output of the machine is 1,200 complete welds per min.



Societe Genevoise "Hydroptic" Size A Jig Boring and Milling Machine

The Triplex Machine Tool Corp., 125 Barclay St., New York, N. Y., American agents for the Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, is now offering the "Hydroptic" Size A jig boring and milling machine. This machine is specially designed for direct production work as well as for the manufacture of jigs and fixtures. Because of the larger scope, it was necessary to eliminate leadscrews, particularly in order to meet the requirements of the milling feed. A measuring screw cannot be expected to impart feed to the table during milling cuts and yet retain its accuracy.

The size of the machine is apparent from the general view from the operating side. The table has a working surface of 27¾x39½ in. Traverse of the table, both when setting the work and during milling operations, is effected by hydraulic power, the maximum longitudinal movement being 37 in. Distance between the uprights is 35½ in.

For the hydraulic traverse oil is supplied by a gear pump built into the gearbox of the machine. When the traverse control lever is in neutral, the oil pressure is released on both sides of the piston and simultaneously the piston rod is locked hydraulically. With the piston rod fixed, fine adjustments of the table can be made by means of the setting screw. When the hydraulic traverse lever is moved in the appropriate direction, the piston is unlocked

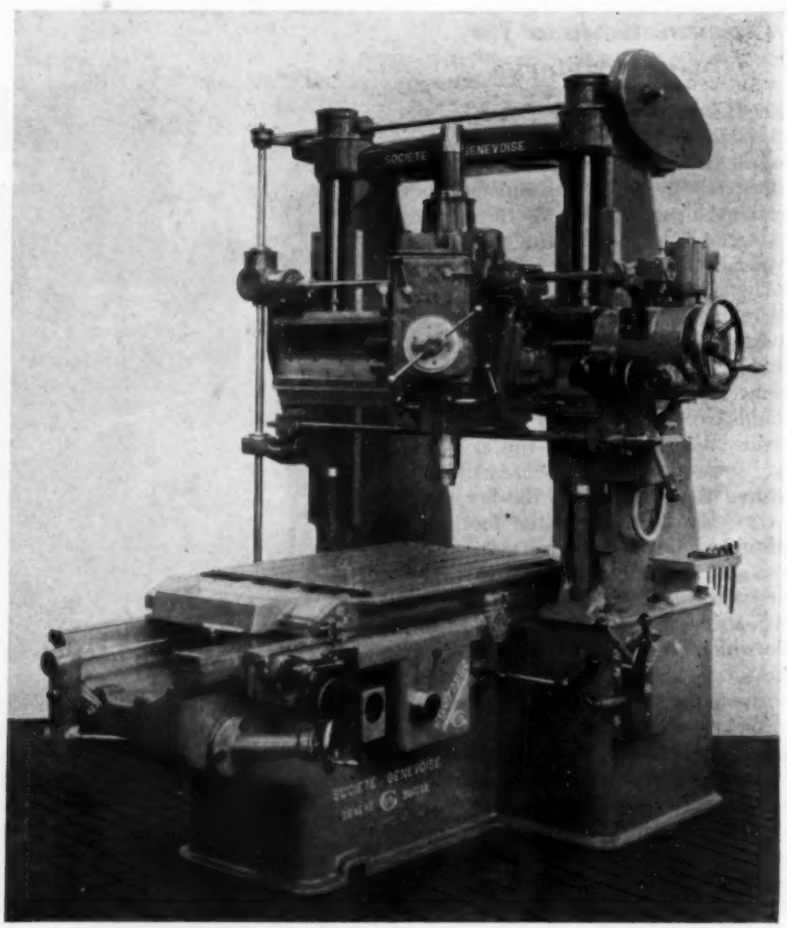
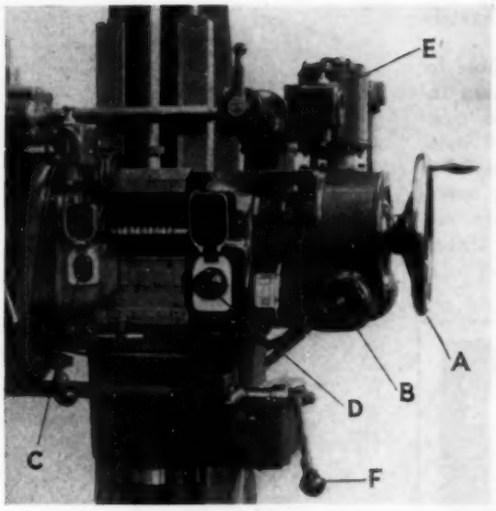


Fig. 1—Both drilling and milling operations can be done on the "Hydroptic" Size A Jig Boring and Milling Machine, so that small lot work can be produced to a high degree of accuracy as well as jigs and fixtures



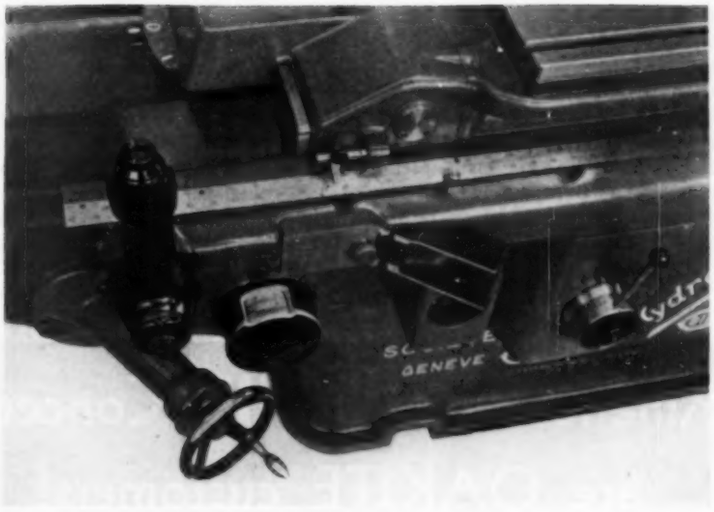


Fig. 2—Close-up showing the controls, traverse motor, and measuring system on the cross-rail. Fig. 3—Close-up of the table setting and hydraulic controls

automatically and the table is traversed at a speed which is variable from 0.05 to 80 in. per min., according to the extent of the lever movement. When setting up the machine or traversing the table the arrangement is such that on release of the lever, it returns immediately to the neutral position. For milling operations a central button on the lever is adjusted, and the lever then remains in any set position. An automatic control valve is provided to insure uniform movement of the table at the set speed, regardless of the resistance encountered.

The cross-rail is adjustable vertically on the columns by power. Vertical traverse of the rail is 20 in., and the maximum distance from the spindle nose to the table is 28 in. Maximum traverse of the spindle is 10 in., and the six rates of power feed are from 0.0016 to 0.01 in. in both directions. In addition, provision is made for both rapid and fine hand adjustment. The eighteen spindle speeds range from 40 to 1,250 r.p.m. The machine has a capacity for drilling from 0.1 to 1.75 in. in cast iron. Diameters from 0.5 to 9 in. can be bored with adjustable tools. There is an adjustable automatic stop for controlling the depth of feed. Tools are inserted or extracted by means of a draw-in rod operated from the spindle nose. Thus, it is unnecessary for the operator to leave his working position.

A close-up of the right-hand end of the cross-rail shows that rapid hand traverse is provided by means of a handwheel *A* and a coarse pitch screw. Slow hand movement for setting is controlled by the small wheel *B*. In addition, there is a power traverse for milling operations at the rate of 2.4 in. per min., driven from the vertical motor *E*. A feature is the use of a friction clutch whereby the slow hand and power feed motions are transmitted to the traversing screw. As soon as the handwheel *A* is operated, a cam automatically disengages the clutch, thus cutting out the power and fine hand feed. When the wheel is released, the power feed is again engaged. This affords special advantages when milling a number of bosses on a work piece. As soon as one boss is milled the saddle is rapidly traversed by hand to bring the cutter to the next boss. The handwheel is then released and the power feed immediately takes over. The saddle has a 24-in. movement.

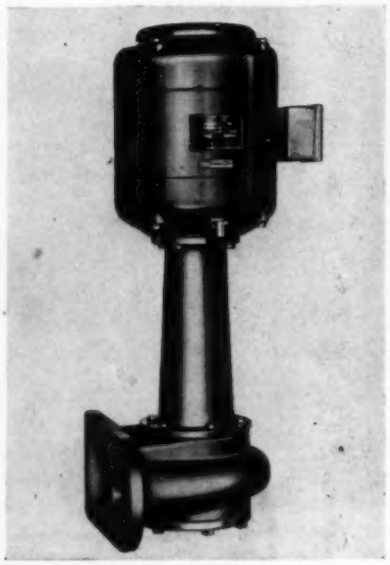
For both the cross-rail and the saddle the precision scales are engraved on the inside of a box-shaped casting which is open on one side to reading by a prismatic microscope. The scales are not subject to wear. The microscope is movable by means of a micrometer screw and the drum is graduated to 0.001 in. while a vernier permits the taking of readings to 0.0001 in. For locating the position of the table, the micrometer is operated until the dotted line of a glass screen is exactly superimposed on the line of the scale in the field of the eye-piece. When the work has been clamped to the table, some point on it must be selected as the origin of the system of coordinates. This point is then centered with the axis of the spindle, and the measuring systems on the cross-rail and the table are set to zero. In the case of the table this might be accomplished by moving an index until it coincides with one of the main graduations on the scale which is calibrated in inches and tenths. Next, the micrometer drum is set to zero. Assume that the setting for zero has been made with the table index against the 10-inch graduation on the scale, and that it is required to move the table 11.2345 in. to the next position. The bed index is adjusted to read 21.23 in.; that is to say, between 21.2 and 21.3 graduations, the second decimal place being roughly estimated. At the conclusion of the operation in progress the hydraulic table traverse is engaged, and the movement is continued until the table and bed indexes coincide. The hydraulic traverse is then arrested, and the fine-adjustment handwheel is employed to obtain the final setting, as observed through the eye-piece. When the dotted line on the glass screen and the image of the scale line are superimposed, the table and work have been moved through the required distance.

Ruthman Model 11027 Gusher Pump

The Model 11027 gusher pump, manufactured by the Ruthman Machinery Co., Cincinnati, Ohio, can be installed, with merely five cap screws, entirely independent of piping. No pipe, hose or tubing is connected to the pump. The intake supply flows into the pump by gravity to the opening provided in the mounting pad on the side of the machine, and the discharge is transmitted directly into the base of the machine. The delivery pipe is connected independently to the

inside wall of the reservoir, in line with the discharge opening in the pump. The pipe can be internally fastened to the walls of the machine by threading, caulking or expanding. This installation makes it possible to confine the piping to the inside of the machine. The pump operates in a vertical position, and is driven by a built-in motor. Its capacity, with a 1-hp., 1,725-r.p.m. motor, is approximately 150 g.p.m.

High efficiency is made possible by the pump's internal twin suction intake. There are two separate compartments which communicate independently with the upper and lower eyes of the impeller. When in operation, the double pumping action creates a hydrostatically balanced thrust.



Ruthman Model 11027 Gusher Pump

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7 out of 10★ makers of electric meters use Oakite Materials

A meter is essentially an accurate device. Precise performance is an indispensable characteristic.

That is what makes significant the fact that seven out of ten makers of electric meters use one or more of the different Oakite materials designed for industrial cleaning. As an important step in production, QUALITY cleaning is required for a QUALITY product.

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★ *7 of the 10 manufacturers of electric meters (Ampere & Volt), rated AAAA in Thomas' Register use Oakite Materials.*

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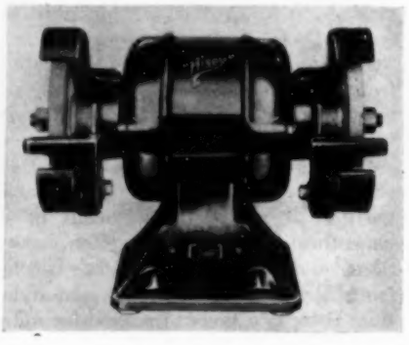
SPECIALIZED INDUSTRIAL CLEANING MATERIALS & METHODS

Skilsaw Bench and Pedestal Grinders

A line of bench and pedestal grinders and combination grinder-buffers, both bench and pedestal types, has been added by Skilsaw, Inc., 3310 Elston Ave., Chicago. Motors in the bench grinders range from ⅓-hp., split-phase type or condenser type in the 6-in.size, to 1½-hp., 220 volts, 3-phase type in the 10-in. size. Motor design and construction of the line of combination grinder-buffers are identical to the bench grinder, excepting that motors in these units are all condenser type. Guards on the larger models are the inclosed type. The toolrest and guard can be removed for buffing work. The unit is equipped with a switch in the base, 10 ft. of cord and plug, one coarse and one fine grinding wheel. On the combination grinder-buffers, a tough durable wire brush is standard equipment on the buffer side of the unit. A buffing wheel may be had in place of the wire brush. A medium grit wheel is on the grinding side of the tool.



THE ROUND TABLE

Change in Design

"Want to help me out of a jam, Ed?"

"Of course, Al. I always do if it doesn't cost me too much."

"Here's the job. A customer wants a compressor, but wants us to change some of the controls to suit his ideas."

"Well, why not? He's paying for it."

"But his notions are all wrong. The compressor won't perform as well or be so convenient to operate. I hate to make the changes he wants against my better judgment."

"Why worry about that? Anyone will know it isn't our standard design."

"I'm not so sure, Ed. The average engineer, who sees it, will just look at the name and turn up his nose at the design. He won't stop to think of its being different."

"Well, I'd make it his way and charge him plenty. Never heard of a buyer being so fussy before. Did you?"

"I sure did, Ed. An old friend of mine had very strong ideas as to what was good design. His machine had unfinished handwheels so the mechanic with oily hands could always get a grip on them."

"Well, what happened, Al?"

"One buyer insisted on having the wheels polished. The maker said they were better as they were, that the customer could polish them after he got them if he wanted to but that he, the builder, had no facilities for polishing."

"And what happened, Al?"

"The deal was called off. Both sides were stubborn, and there was no sale. It was a $35,000 order too."

"Served him right for being mulish, Al. I always knew you were stubborn, but don't lose an order on that account. Our prospect might buy a compressor somewhere else, and right now we need the business."

"That's what the other buyer thought. But by the time he placed his order elsewhere and got his machine, the war was over, and he had a white elephant on his hands. His stubbornness cost him more than it did the builder of the machine."

"It just goes to show that stubbornness doesn't pay on either side if you ask me, Al."

"I'm not sure you should call this stubbornness on my part. I know what is best for the machine and what will give the best service. The user should only buy results, not details."

Should the builder change design to suit his customers when it affects operation adversely? Or should he stick to his point even at the danger of losing an order?

Discussion

Finish Cuts only

If Al has enough work to keep both machines busy a reasonable amount of the time, he is justified in keeping one machine for finish cuts only. He should be able to improve the quality of the work and increase production as the man doing the finishing operation will be able to cut down the time for setting up.

Savings will also take place in the assembly line when the work is uniform in quality and is held to closer limits.

—THOMAS M. GARRY,
Instructor, Apprentice School, Yale & Towne Mfg. Company.

Al's idea of keeping one machine for roughing and another for finishing is not good economy. Work could be turned out more economically by using oversized machines; it is better not to put work on a machine that is too large.

For example: A 20-in. lathe would have a spindle large enough for roughing and finishing 12-in. work without damaging the working parts; whereas an 8-in. lathe having its heads blocked up to take 12-in. work might easily be damaged in doing one or two jobs. Another objection to having a separate machine for roughing and finishing is that certain workmen only would be allowed to run the machine reserved for finishing.

—C. F. STAPLES.

Shop Instructions

The need for instruction sheets is best determined, not by the size of the shop, but by the class of work it handles. To say that instruction sheets are unnecessary, and that a shop foreman should be capable of supervising the production of any component without them, shows a limited knowledge of some of the work that is being produced today in many machine shops.

Instruction sheets should be made in sufficient detail to convey all the information necessary for the complete manufacture of the components from raw material to stores. All special tools for each operation should be specified and their identification numbers should be given against the operation. Special instructions regarding

grinding allowances may be necessary, and where parts are to be heat-treated it is advisable to enter those operations in their proper sequence on the instruction sheet.

In the manufacture of airplane-engine and motor-vehicle components, it is not unusual for parts to require as many as 40 or more operations for completion. To attempt to manufacture such parts without previously giving careful consideration to the best methods of production would certainly be inviting failure.

—W. L. Waterhouse,
Bristol, England.

The use of instruction sheets is both business like and necessary for repetitive work in the small shop. Laying out the jobs on the instruction sheets collectively reduces the clerical work greatly. But if the instructions can be subdivided, so much the better. The most satisfactory method, after the work has been satisfactorily produced, is to tabulate the procedure of each operation and, if thought necessary, to mark the tools, jigs and other equipment with the job number.

The question of stifling the initiative of the workmen regarding the methods on the sheets does not arise, because a repetitive job would soon lose its profits if it were open for any operator to do the job as he liked. In the smaller shops, the foreman or the owner will consider the suggestions of altered methods, and in the larger shops there should be the suggestion boxes or their equivalent.

One of the greatest advantages of the instruction sheet is its adaptability to other purposes, so that with simple ¼-in. margins, as necessary, it can become a daily progress sheet, time sheet, cost sheet and, particularly to the small shop, a record of work done, providing a check on the account sheet if disputed by the customer. I have used a similar scheme with the addition of thumbnail sketches of essential parts for several years, covering over 11,000 jobs.

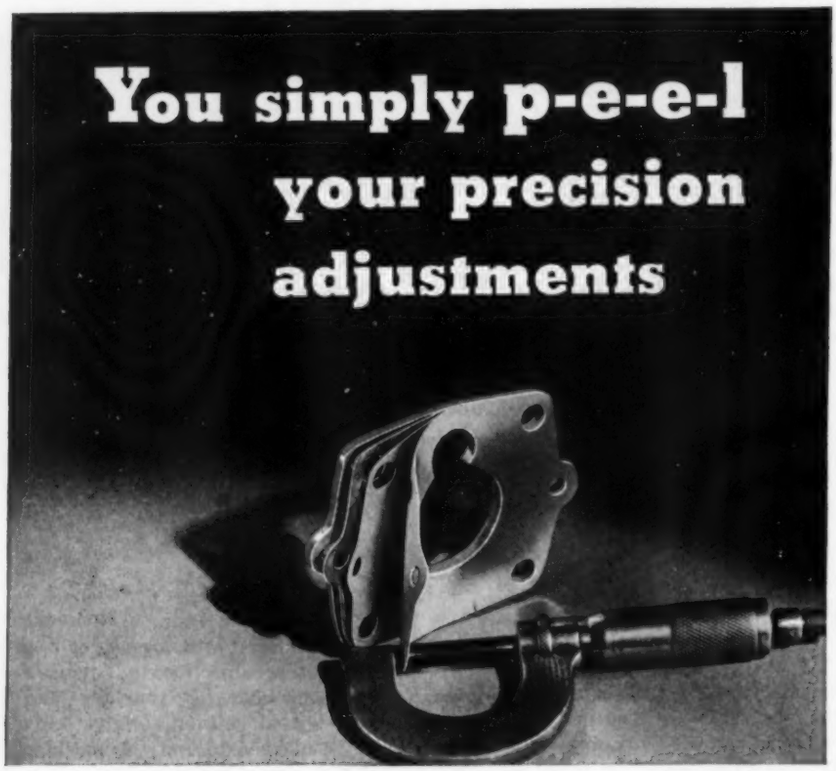
—W. A. Harris,
Coventry, England.

Codified Skill

During the war, labor had to be placated at any cost, and so there was a worker's market and higher wages prevailed than at any other time. A few years later the slump developed, and the employer had the advantage. The worker's lot in some shops became plain hell. Now there is a skilled workers' market in London and a good toolmaker can get a high wage.

The object of the minimum rate is to secure a living wage. This rate may be made secure either by law or by the power of the labor union. In so far as the aim of the minimum rate is to secure a decent living wage, it should apply to all trades. There is nothing whatever in this to prevent extra pay as recognition of unusual skill. But fixed rates as a means of getting a living wage is only part of the problem. For example, the full time worker must have the right to earn sufficient to cover sickness and old age, or proper education for his family and other necessities. This goes far beyond what any minimum wage offers. In this respect payment by results is better than by the minimum wage.

—M. P. Dalton,
Kemsing, Sevenoaks, England.



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LAMINUM

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Who Buys the Micrometers

There are always some things lacking in every toolroom, principally tools or gages that the men depend on the firm to supply. If Al wants to invest the amount it will take to buy several sets of micrometers, he would do well to check his toolroom equipment and see if the money couldn't be used to better advantage. Or he could consult his men who would doubtless furnish him with a list of things long enough to give him a headache.

The trouble Al has been having with inaccurate work is just one of the things a foreman must contend with, and which it is his duty to correct. His men are probably unaware of the discrepancy, and if he should explain it to them, he will be surprised at the cooperation received.

Even though the toolroom kept all the micrometers necessary, Al would find that most of his men would use their own tools anyway. A good mechanic jealously guards his mikes and doesn't care to use those which are let out for general use.

—W. J. Owens.

In the small shop employing from five to ten machinists, Al's idea of supplying micrometers and other precision tools will work admirably. But in the larger shop there is the question of expense in supplying and maintaining such tools in quantity, and unless there is a good stock on hand considerable time may be lost by workmen waiting for tools that others are using.

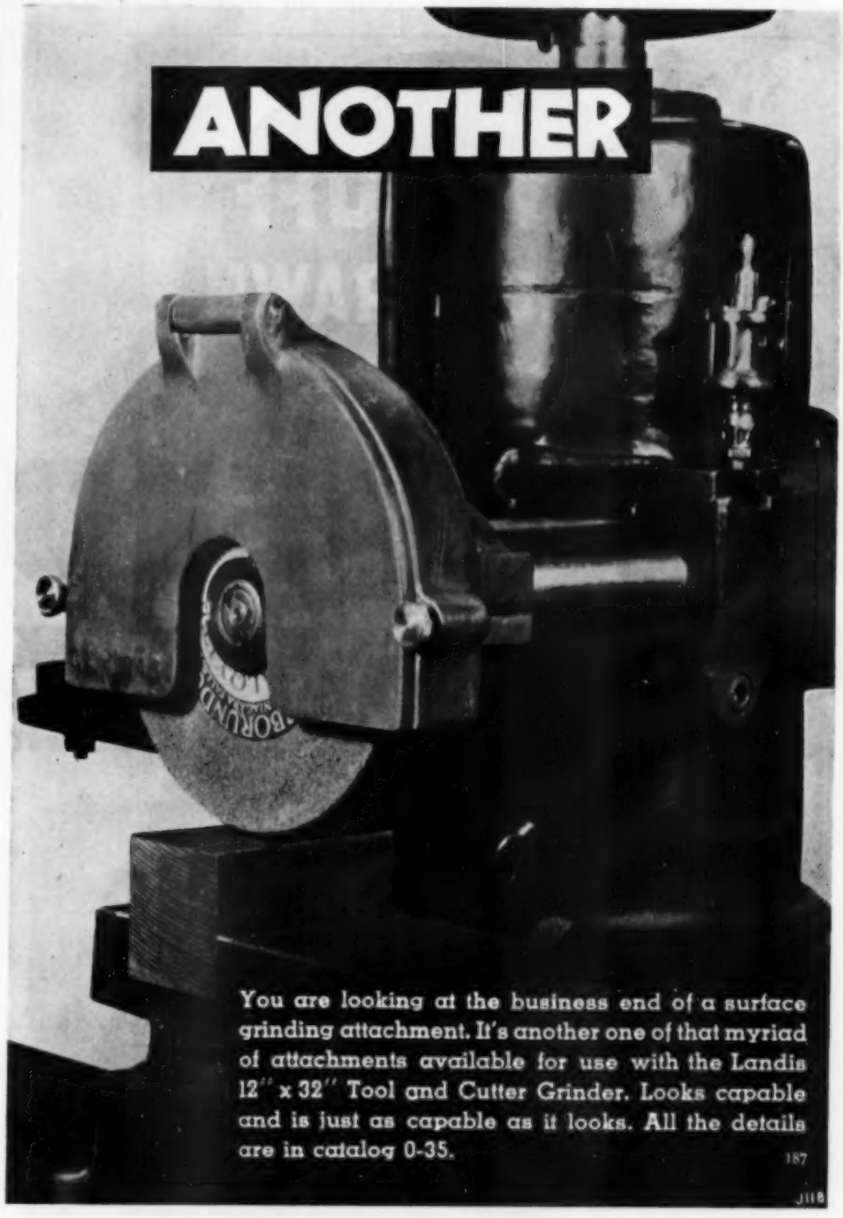
I know of one shop where the men own their own precision tools and are permitted to use the toolroom gage blocks for testing them. The men are encouraged to replace worn out mikes and other tools by buying them at a discount through the company, paying for them in installments. Such a plan is for the benefit of all concerned. The men are enabled to maintain first-class toolkits and are thus encouraged to take pride in accurate workmanship, reducing spoilage and lowering the cost of inspection.

—Robert S. Alexander.

Before deciding arbitrarily who will buy micrometers for use in the factory, it is better to consider the attitudes of the various persons involved. Skilled toolmakers are expected to do high grade accurate work, and they must have satisfactory measuring instruments. This type of artisan has great pride in his kit of measuring tools, and I have found that he usually prefers using his own rather than those which have been handled by every Tom, Dick or Harry. He then possesses a greater degree of confidence in his work. This element must be considered. On the other hand, it is the practice of a large majority of toolrooms to purchase the larger sizes of micrometers and other expensive measuring instruments.

In production departments, it is desirable to use gages wherever possible, and they are not expensive. The time the workman consumes reading the micrometer must be taken into account and also the errors possible when gaging his work. Micrometers are needed, however, for various purposes in the production department, and it would be best for the plant to have its own for these divisions, as well as bearing the expense of the gages.

—Peter L. Budwitz.



You are looking at the business end of a surface grinding attachment. It's another one of that myriad of attachments available for use with the Landis 12" x 32" Tool and Cutter Grinder. Looks capable and is just as capable as it looks. All the details are in catalog 0-35. 187

J118

LANDIS TOOL CO.
WAYNESBORO, PA.

• TRADE • PUBLICATIONS

CHAIN DRIVES. Book No. 1425, being distributed by the Link-Belt Co., 300 West Pershing Road, Chicago, Ill., describes the use of "Silverstreak" silent chain drives in many industries, and gives a list of distribution points.

GRINDERS. Type C hydraulic internal grinders in the 15 in. size are described in Bulletin No. E-35 issued by the Landis Tool Co., Waynesboro, Pa.

CHUCKS. The Skinner Chuck Co., New Britain, Conn., has published catalog No. 48 describing its hand-operated chucks. Each type of chuck is illustrated and dimensions are given, together with the prices.

GEARS, SPROCKETS AND CHAINS. The Medart Co., Potomac and DeKalb Sts., St. Louis, Mo., has published catalog No. 56G containing standard listings, weights and dimensions of its gears, sprockets and chains.

INDUSTRIAL VACUUM CLEANING. The United States Hoffman Machinery Corp., Air Appliance Division, 105 Fourth Ave., New York, N. Y., published a booklet "Remove the Menace of Dust," which deals with the general subject of dust hazards in industry and describes the company's industrial vacuum cleaning apparatus and gives many illustrations of its use.

MOTORIZED REDUCERS. The Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa., has available book No. 1515 on motorized speed reducers, together with a list-price pamphlet. Information on selecting the reducers, a table of service factors and dimension sheets are included.

PACKINGS AND OIL SEALS. Bulletin 701 issued by the Michigan Leather Packing Co., 752 Fourteenth Ave., Detroit, Mich., includes illustrations and description of an exacting test made on its oil seals and leather packings.

POWER TRANSMISSION. A booklet "A Practical Analysis of Some Fundamentals of Industrial Power Transmission," has been prepared by the Power Transmission Council, 370 Lexington Ave., New York, N. Y. The booklet graphically presents some of the results of a three-year study of power transmission costs under a wide variety of conditions in the plants of representative industries.

ROTARY TOOLS. Publication SP-1876, put out by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., presents its line of "Power Vane" drills, grinders and polishers. Many models are illustrated, and a large cross-section view shows details of construction.

STEEL STOCK LIST. A. B. Murray Co. Inc., 147 Wolcott St., Brooklyn, N. Y., has published a complete list of steel and boiler tubes in stock. The booklet contains 56 8x5-in. pages.

TAPS AND DIES. Supplement No. 3 for Catalog No. 30 has been published by the J. M. Carpenter Tap & Die Division, of Whitman & Barnes, Inc., Detroit, Mich. The booklet discusses the evolution of the "Super-Crest" tap, and lists many different taps and dies available, as well as screw plates and thread gages.

VALVES. The Parker Appliance Co., Cleveland, Ohio, has published Booklet No. 38, covering in 60 pages a typical line of valves adapted to special conditions and services.

WELDING ELECTRODES. A leaflet put out by the Air Reduction Sales Co., Lincoln Bldg., New York, N. Y., describes Airco's shielded-arc electrodes, No. 78, 79, and 81. A table of recommended current values for various welding positions is included.

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American Machinist

APRIL 10, 1935

Auto Parts Inspection

FRED H. COLVIN
Editor, American Machinist

Simultaneous checking of several dimensions and ready means of reading results play a part in making Dodge inspection methods accurate and rapid

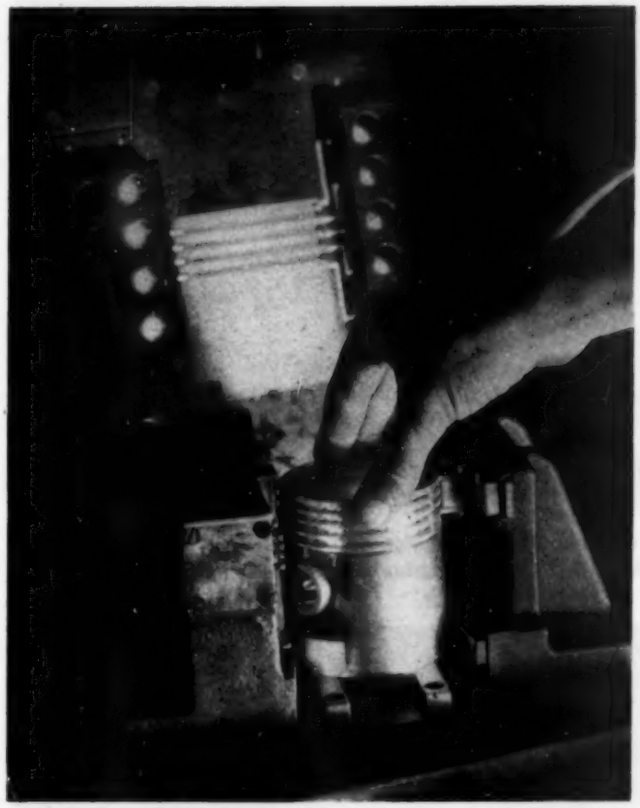


Fig. 1—Electricity has been put to work in modern inspection devices. Here an "Electro-Limit" gage is shown checking nine dimensions simultaneously. Inner rows of lights show "go" limits; outer rows, "no go" limits

NO ONE who has watched the building of automobiles grow from small job-shop beginnings to the highly organized manufacturing institutions of the present can fail to be impressed with the changes that have taken place in inspection methods and the uniform product that has resulted. One of the interesting developments is in electrically operated gages. The inspection gages and methods that follow are from the Dodge plant of the Chrysler Corporation.

The gage, illustrated in Fig. 1, checks nine points on the piston at one time. With the skirt resting on two steel strips, the piston is guided between the nine gaging points that are indi-

Fig. 2—Eccentricity at two points is measured by the two dial indicators, the center still being in the piston head

Fig. 3—Slight relative movement of the plug in the pin hole and of the side guide plates causes the gage to show the error in squareness

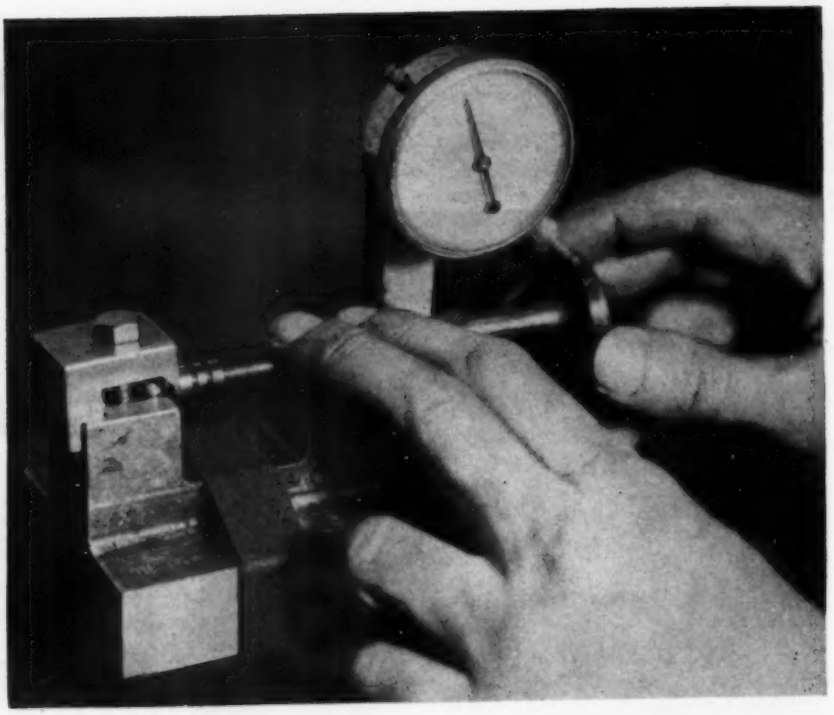


Fig. 4—Great care is taken to insure concentricity of valve seat and valve head. Checking the valve face is shown

cated on the illuminated diagram at the back. The four points at the left contact the bottoms of the four piston ring grooves, while the five points on the right check the diameter at the head, below the last ring and at the three lands between the ring grooves. When these nine dimensions are within the tolerances set, the small lamps in the inner row on each side light up. Should any of these dimensions be outside the tolerance, the corresponding lamps in the outer rows light and immediately attract the attention of the inspector.

Concentricity of the piston is checked as in Fig. 2. The center is still in the piston head, and the piston is revolved by hand between this and a bull center that fits into the beveled end of the skirt. Two dial gages indicate and measure the amount of eccentricity at two points.

A third piston inspection is for the squareness of the piston-pin hole, which is done on the fixture in Fig. 3. A close-fitting plug goes into the hole as the piston is put on the gage; the piston skirt fits on the hardened side plates on each side of the gage. The plug in the pin hole and the guide plates in which the piston rests have a slight relative movement that shows when the pin is out of line. The amount of the error is shown on the

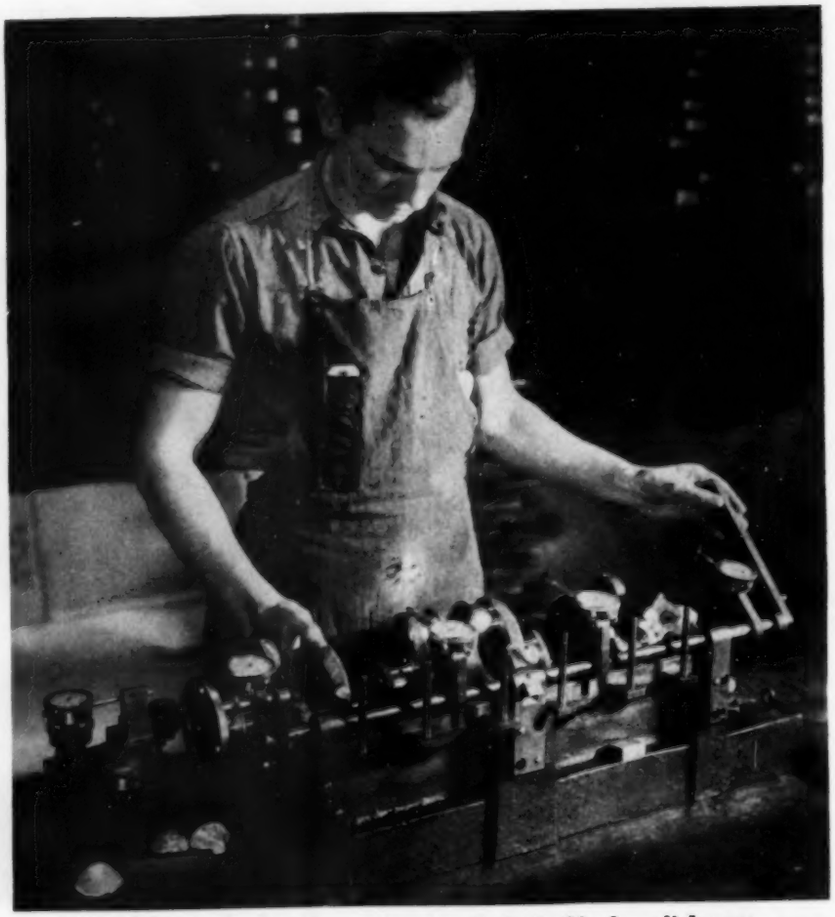


Fig. 5—Roundness of the main bearings is checked by four dial gages. Indicators at the left test run-out and wobble of the end flange

Fig. 6—Another electric gage checks the big end of the rod. The meter on the wall shows the irregularity as the rod is turned on the plug

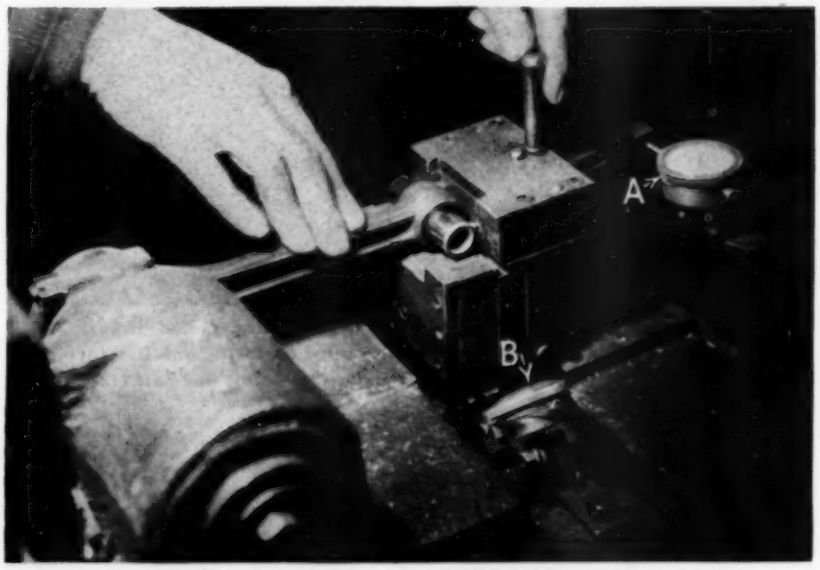


Fig. 7—Rod squareness is checked by this modern gage. Lengthwise alignment is checked by the dial at the right; cross alignment by the dial at the center

dial gage at the base. This can be doubly checked by reversing the piston end for end or by turning it halfway round. Needless to say, the accuracy of the fixtures for cross boring the pistons is watched so closely that the variations from exact squareness are slight.

Valve seat accuracy is also closely watched. Every valve, before it goes to assembly, is tested in the device in Fig. 4. The valve is laid in an accurate V-block and positioned by the tail piece at the left, so that the head is always in the correct position. The inspector then turns the head with his thumb and fingers, with the indicator point in contact with the seat. Any variation is clearly shown on the dial indicator. This is a portable fixture that can be easily carried wherever needed.

Main crankshaft bearings are checked in the fixture shown in Fig. 5; four dial gages check the roundness of the main bearings. These gages are all mounted on arms attached to the shaft at the back with the handle at the right. With these gages swung down to contact with it, the shaft is revolved slowly, and readings are taken on each bearing. Movement of the rod carrying the dials is limited in extreme positions by a stop at the center. The indicators at the left test both run-out and wabble of the end flange. Location of the crank pins is checked by six slides. The width of these is equal to the length of the crankpins, and they are located to show the center distance between the cylinders and to check any error in crankpin spacing.

Connecting Rod Inspection

An electric gage is used for checking the diameter, taper and roundness of the large end of the connecting rod, as in Fig. 6. This is a Pratt & Whitney gage. The rod is placed on a plug, which has two carbide contact strips on the upper side and a diamond gaging point opposite. As it is turned on the plug, any irregularity is shown on the gage on the wall. The slightest movement of the diamond on the surface of the bore, is multiplied several thousand times on the gage through a delicate magnetic circuit, which is protected against damage. Maximum and minimum gages are used in setting the instrument. With the high and low limits marked on the dial, it is only necessary for the inspector to see that the needle stays between these marks. Gages of this kind are highly accurate and work can be handled rapidly by their use.

A test for rod squareness is made on the gage in Fig. 7, which is much more accurate and complete than gages of the old type. The large end of the rod is placed on the pin, and the small end swung down on the gaging points at the right. There are two horizontal and two vertical contacts, each pair being pivoted, or floating, so as to contact the pin at each end. Alignment lengthwise of the rod is checked on dial *A* at the right, and cross alignment on dial *B* bolted to the center of the base. With the gages set at zero from a master rod and pin, the movement of the needle to either side is made to show both the amount of error and its direction. Care in these details is one of the reasons for the long life of the modern motor.

Turret Lathes on Unusual Materials

J. R. LONGSTREET

The Warner & Swasey Company

MANY manufacturers are overlooking a possibility of making an extra profit from the operation of their turret lathes because they are not thoroughly familiar with the methods used in machining some of the more unusual materials. This is perfectly natural, for with the development and application of these unusual materials, a techinique must be developed for successfully machining them.

During the past two or three years, these materials have been enjoying an increasing use. Cemented carbide tools, diamond tipped cutters and redesign of turret lathes to accommodate the new high-speed cutting conditions have all combined to bring about this increase. The production department, the time study, the estimator, the tool designer, and machine operator have all had painfully to unlearn one bag of tricks and learn another to meet the new situation.

Magnesium for Example

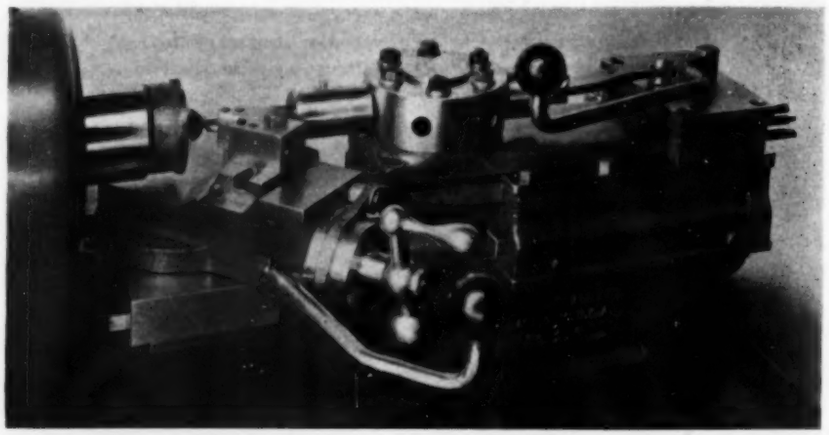
Magnesium alloy is one of these materials. Made from magnesium salts, found in the salt mines of Michigan, this new metal has characteristics different from any other with which we are familiar.

Its lightness and high tensile strength make it ideal for certain airplane parts. The increasing use of the airplane has naturally created an important market for parts made of this metal.

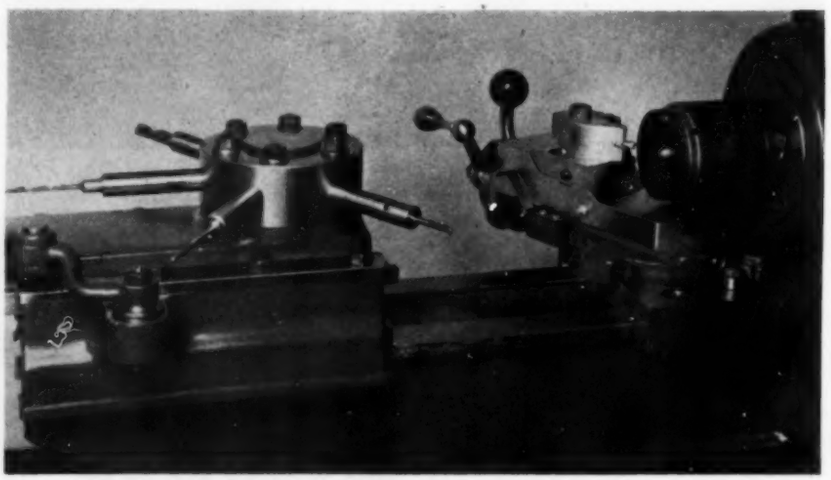
Magnesium alloy is used in making both forgings and castings. The primary precaution that must be taken in machining it, is to prevent distortion in the holding method. For identical sections of differing materials, the index of the material to resist chucking or holding deformation is to be found in the modulus of elasticity of the material. The modulus of elasticity represents the ratio of the increment of unit stress to the increment of unit deformation. When it is realized that cast iron has a modulus of 15,000,000 lb. per sq. in. and above, and steel has a modulus of 30,000,000 lb. per sq. in., as compared to 5,000,000 to 6,000,000 lb. per sq. in. for magnesium, the weakness of this alloy at once becomes apparent.

In the handling of forgings and castings of this material on the turret lathe, it is frequently impossible to use either standard or special chuck jaws for holding shapes and sections that the ferrous group could readily be chucked. Often it will be found that the sole purpose of the chuck is that of a centering device, the actual gripping being accomplished by a separate holding fixture built on the chuck face. In other cases, an entirely separate fixture must be built. In every case, the clamping should be through solid sections of metal if at all possible.

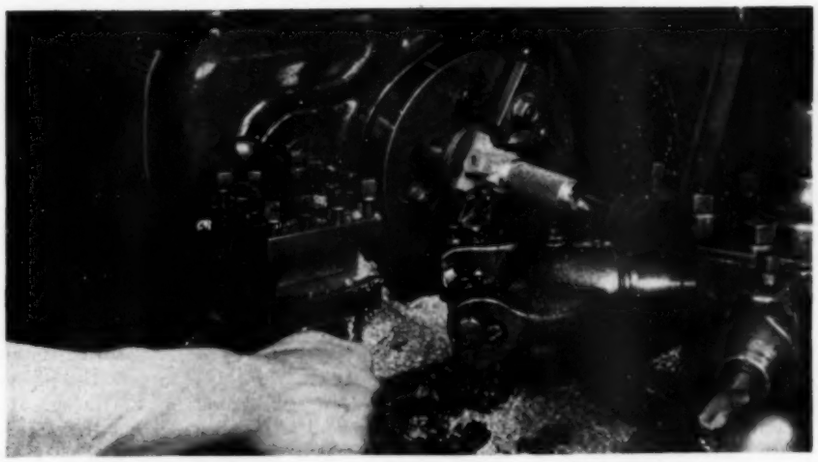
Usually, it will be found that these magnesium alloy castings are of thin section. This brings up the next phase in the holding problem. Flanges and the like that must be faced and turned must be adequately supported to prevent distortion under cut. Because of its tendency to bend away from the



Diamond turning and facing of hard rubber Nutating meter disks. The chucking shows diamond-tipped cutters mounted on facing and ball-turning cross-slide for machining the concave surface and one-half the ball



Second chucking on Nutating disk, with diamond tipped cutter for facing convex side and other half of ball



Magnesium alloy handle—note method of holding—clamping over solid sections of casting to avoid deformation

cutter, the material is difficult to form.

It is not necessary to use special types of cutting tools in machining magnesium alloys. High-speed steel tools, if used with the same clearance as in machining aluminum, will function with high efficiency.

High-speed steel cutters will operate at 400 to 600 ft. per min. in roughing and from 600 to 800 ft. per min. in finishing, varying with the composition of the alloy. Cemented carbide tools can be run at a speed of approximately a 1,000 ft. per min. for roughing. Fine feeds, as in the case of aluminum, are used.

The exact cutting speeds, however, are determined finally by the composition of the alloy. Cutters should be well supported and spindle bearings properly fitted to eliminate another source of low grade finish. The use of ground gear teeth in headstock gears, together with precision anti-friction spindle bearings has done much to overcome the chattering tendency in handling these light alloys on turret lathes.

Constant caution must be taken to prevent fire during the machining process. Magnesium chips are highly inflammable and carelessness may result in disastrous fires which at best may reduce a turret lathe to a useless piece of equipment. A fire caused by magnesium cannot be quenched by either water or the usual fire extinguisher. It must be thickly blanketed with sand which stops the flames but will not stop the fire itself. This continues to burn under the sand until the metal is reduced to a small heap of white powder. Because of this characteristic, it is best to machine the magnesium alloy dry and to eliminate all cutting lubricants.

Hard rubber and bakelite are among the unusual materials for the majority of manufacturers. These materials, however, are readily machined on the new high-speed, motorized-spindle turret lathes. In general, the parts to be machined are of simple shape. Consequently, the holding problem is not a complex one. These materials distort easily and mar under heavy chucking methods. The principal precaution to be exercised is one of balance. Diamond-tipped cutters are frequently used, consequently balancing must be of the dynamic type because of very high surface speeds.

The abrasive nature of both hard rubber and bakelite is such as to break down quickly the cutting edge of any cutting tool except the diamond. This is especially true if ground mica is added in the manufacture of the rubber or bakelite.

Since in most cases hard rubber and bakelite jobs resolve into the high production type, involving short cuts, fine feeds and long runs, the problem becomes one of getting the maximum speed from the diamond coupled with long life of the tool. This is accomplished, first, by having a machine carefully balanced against vibration and capable of sustained speeds up to 3,000 surface ft. per min. and, second, by having the diamond itself carefully cut by a lapidary who is expert in working with these gems.

The diamond is mounted in a round shank. A hole is drilled into one end into which the diamond will fit snugly. A low-temperature brass alloy is then melted and flowed into the hole sealing the diamond securely in the shank. The shank is then ground away to expose the diamond tip, and the diamond tip ground and polished with the necessary face, rake and clearance angles, or ground to definite shape if used for forming. The round type of shank is used to advantage with diamond tips since it allows the best use of the clearance angles ground on the tip and further allows of reworking of the tip with the minimum dressing.

Certain precautions must be taken in using this cutting tool. It must be realized that the diamond is a brittle tool, therefore, it must be guarded against impact, sudden blows, or being stopped and started in the cut. Another important factor is to guard against back drag over a machined surface. This avoidance of back drag is not only for the purpose of preserving the tool, but for the prevention of tool marks. Because rubber or bakelite are relatively soft materials, these drag marks may be serious.

Diamond Tool Adjustment

The mounting of the tool shank in the turret lathe is somewhat different than in the case of ordinary cutting tools. Because of the character of the diamond tip, the final ground top plane of the cutter in relation to the center line of the shank is indeterminate, therefore, it is imperative that adjustment other than ordinary shimming methods be incorporated in the tool holders. For best results, it is necessary to incorporate micro screw adjustments in vertical and lateral planes independent of any slide motion.

The diamond tip can be used equally well for facing, boring or forming, and is used always on high-production precision jobs. When once set, it will produce from 15,000 to 20,000 pieces from bakelite or hard rubber without regrinding.

Because of the potential high production of the diamond tip and its use on precision parts, the construction of special tools must take into consideration a carefully thought-out plan of gaging the cutters in position. The use of ordinary block gages is not entirely satisfactory since too heavy a contact with the diamond may chip the cutting edge. Best results are obtained when gages are used that allow of visual check by dial indicators.

Because of variation in size and shape of the diamond tips, the price variation with size and grade and the special character of the grinding equipment, it is not the practice of the machine tool trade to quote prices on diamond-tipped cutters. These cutters are usually supplied direct to the customer through regular diamond tool agencies.

Tools for Recessing and Undercutting

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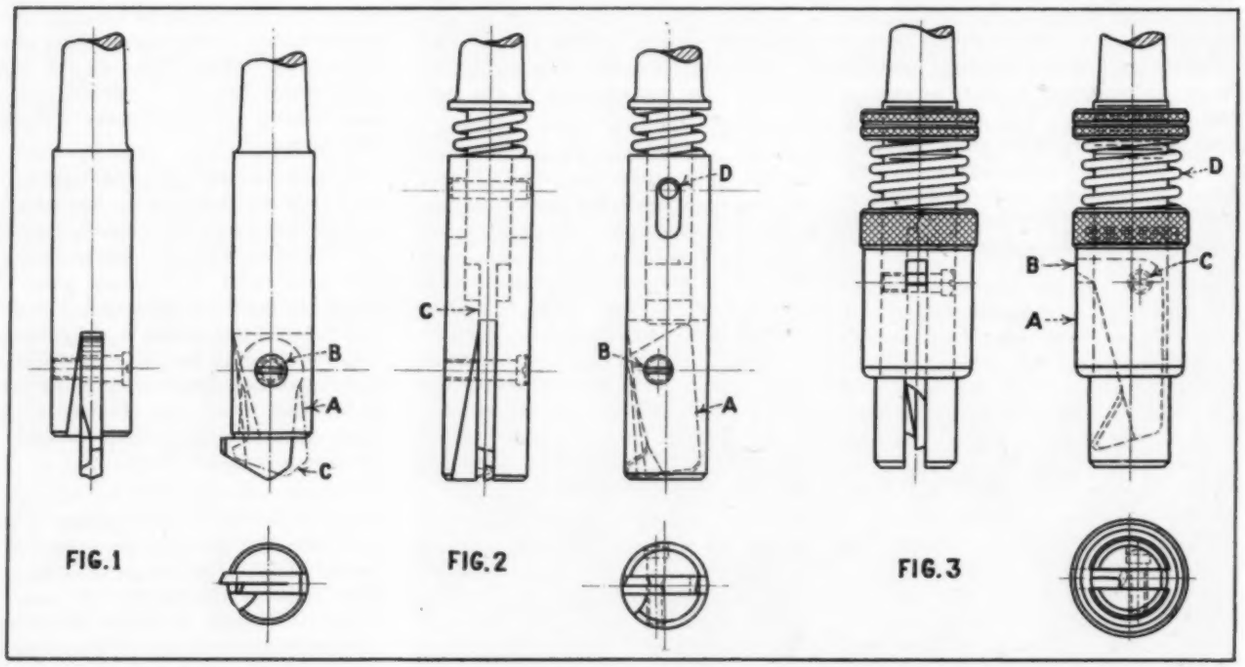
RECESSING or cutting clearances in holes, either at the bottom or at some predetermined distance from the surface of the work, is a problem in tooling that presents itself periodically in the experience of most designers.

To facilitate tapping blind holes, the tool illustrated in Fig. 1 will be found effieient. It operates on the same principle as that of the well-known wabble drill. The cutter *A* is located in a slot in the arbor and is pivoted at *B*. When the cutter reaches the bottom of the hole in which the recess is to be cut, its heel *C* makes contact with the angular surface left by the drill and the cutting point is forced outward. As continued downward pressure is applied, the cutting point is forced into the work, making an undercut for clearance for the tap.

A slightly more elaborate variation of the tool just described is shown in Fig. 2. This tool will undercut the wall of a hole having a flat bottom. The cutter *A* is pivoted at *B* and is located in a slot in a sleeve that slides on the arbor. When the sleeve reaches the bottom of the hole, further downward movement causes the tongue *C* on the lower end of the arbor to contact with the angular top of the cutter, forcing the cutting point into the wall of the hole and making the undercut. Vertical movement of the sleeve on the arbor is limited by the pin *D* which engages a slot in the sleeve, and this pin, together with the tongue on the arbor, transmits the rotary motion of the arbor to the sleeve and to the cutter. A stiff spring interposed between the sleeve and a shoulder on the arbor draws the tongue on the arbor out of contact with the cutter as the tool is withdrawn from the hole, permitting the cutter to move into the slot.

In the tool illustrated in Fig. 3, the slotted end of the arbor serves as a pilot. A sleeve on the arbor is held in contact with a shoulder at the top of the pilot by a stiff spring interposed between the top of the sleeve and the checknuts on the arbor. In the wall of the sleeve is cut the slot *A*, in which the projecting tongue *B* at the top of the cutter engages. When the pilot has entered far enough into the hole, the bottom of the sleeve contacts with the surface of the work. Continued downward movement of the tool pushes the arbor farther through the sleeve and causes the under part of the tongue at the top of the cutter to contact the bottom of the slot in the sleeve, swinging the cutter on its pivot and forcing the cutting point outward into the wall of the hole.

The distance from the surface of the work to the recess is controlled by the distance of the cutting point below the pilot shoulder. As the tool is withdrawn from the hole, the sleeve is kept in contact with the surface of the work by the spring *D* until the shoulder at the top of the pilot reaches



Figs. 1, 2 and 3—The first two tools are for cutting recesses at the bottoms of holes. The third tool is for cutting a recess at a predetermined distance from the surface of the work

the surface of the work. The rising arbor then causes the upper part of the tongue on the cutter to contact with the upper edge of the slot in the sleeve and to swing the cutter on its pivot so that the cutting point will clear the wall of the hole.

The tool illustrated in Fig. 4 is for cutting a recess at a predetermined distance from the surface of the work. The sleeve A_1 is an easy fit in the hole and is relieved at B. The square toolbit C has a head at the back and is carried in the round block D, against which the screw plug F bears. A tongue milled on the arbor has an angular surface at H which bears on a like surface in a slot in the carrying block.

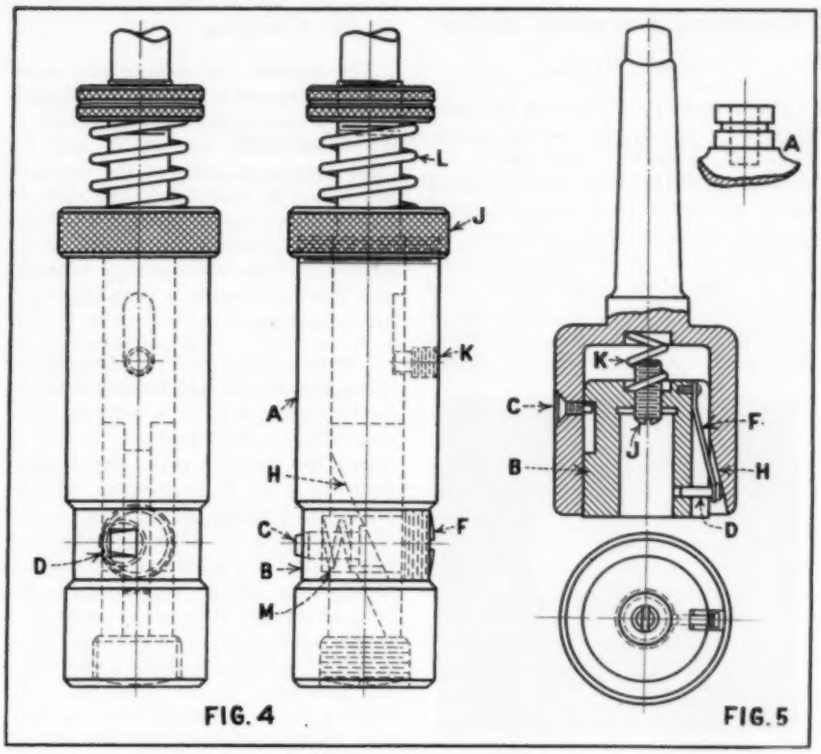


FIG. 4 FIG. 5

Figs. 4 and 5—The tool in Fig. 4 is for cutting a recess in a deep hole at a predetermined distance from the surface of the work. The tool in Fig. 5 is for cutting a recess in the outside of work

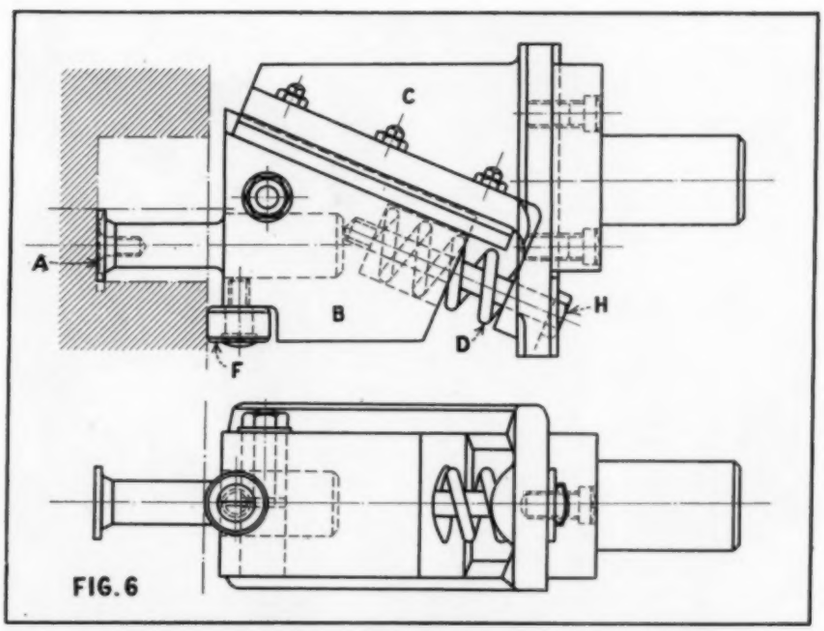


FIG. 6

Fig. 6—This tool is for use in a turret lathe. On the forward movement of the turret, the lower block is arrested by contact with the work. Further travel of the turret causes the upper block to slide on the lower one, forcing the tool to the cut

In operation, when the tool is entered into the hole and the collar J has come into contact with the surface of the work, continued downward movement of the tool brings the angular surface of the tongue on the arbor into contact with the angular surface of the slot in the carrying block. This forces both the carrying block and the toolbit outward, cutting the recess. The depth of the recess is controlled by the screw K in the sleeve engaging a limiting slot in the arbor. In removing the tool from the hole, the sleeve is kept in contact with the surface of the work by pressure of spring L, and the rising arbor withdraws the angular tongue from the angular slot in the carrying block D, permitting the toolbit to be forced inward by the spring M. Rotary motion of the arbor is transmitted to the sleeve by the tongue engaging the slot in the carrying block and by the point of screw K engaging the limiting slot in the arbor.

For External Grooves

A useful tool, which is seldom exploited, is illustrated in Fig. 5. The principle of a spring-loaded tool operated by an angular surface is used to cut a recess in the outside of work, as at A. The body of the tool is bored to receive the cylinder B, in which the hole is bored to fit the work to be recessed. The point of the screw C engages a slot in the cylinder and transmits rotary motion from the arbor to the cylinder. It also prevents the cylinder from falling out of the body. The square cutter D slides in a square hole in the cylinder and is kept in the outward position by the flat spring F. As the bottom of the cylinder contacts with the shoulder on the work, its downward movement is arrested. Continued downward movement of the arbor causes the cutter to be forced into the work by the angular surface H on the inside of the body, cutting the recess. The tool continues to cut until the stop screw J contacts with the closed end of the hole in the body. As the tool is moved upward, the hel-

ical spring *K* keeps the cylinder in contact with the shoulder on the work until the cutter is withdrawn from the recess by the flat spring. Continued upward movement causes the point of screw *C* to contact the top of the slot and the cylinder then moves upward in unison with the arbor.

A recessing tool for use in the turret lathe is shown in Fig. 6. This tool carries a circular cutter at *A*, the shank for which is held in the lower angular block *B*, which is free to slide on the upper angular block *C*. The spring *D* keeps the lower angular block in its outward position, in which position the cutter clears the wall of the hole. As the turret is moved forward, the roller *F* contacts with the surface of the work and arrests the forward movement of the lower block. Continued forward movement of the turret causes the upper block to slide along the lower block and to push the lower block along the face of the work, forcing the tool to the cut. In withdrawing the tool from the hole, a lug on the rear end of the upper block contacts with the head of the bolt *H*, and the lower block then moves with the turret.

Simple Fixture for Splitting Bearing Blocks Discussion

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In the article by Charles C. Tomney under the title given above (*AM*—Vol. 78, page 778) there are some errors in the illustration. In the side view of the assembly, the slot for saw clearance is shown in dotted lines the whole length of stud *C*, as it should be, but in the corresponding front view it is shown in dotted lines as if it did not extend the whole length of the stud. This is contrary to the side view and to the text.

In the detail drawing of stud *C*, this same slot is shown on the right of the center line instead of on the left, also it extends to the major diameter of the threaded portion contrary to both assembly views. If this view were drawn in first-angle projection, which is quite unlikely since both assembly views are in third-angle projection, and also because first-angle projection is obsolete on this continent, then the slot would be in its proper position as shown, but the major diameter of the threaded portion would then be hidden and would be shown in dotted lines, whereas it is full lined. An omission of minor importance is that of the oil groove shown in the front view of the split bearing but not indicated in the end view.

Machine for Drilling and Reaming Location Holes

FRED B. JACOBS

The manufacture of sewing machines involves a number of special operations not commonly followed in the average machine shop and in many cases equipment must be constructed or arranged for a specific purpose.

Shuttles for the White sewing machines have two holes drilled and reamed at *A*, Fig. 1, so they can be accurately located for succeeding operations. As the holes are drilled from the back and as the surfaces where the drills would ordinarily break through are inclined, bosses are provided and their tops are milled so that the drills will break through flat surfaces and will neither run nor be in danger of breaking.

Fig. 1—Holes are drilled and reamed at *A* for locating the shuttle for succeeding operations

The machine for drilling and reaming is illustrated in Fig. 2. The shuttle fits in a nest in the holding fixture at *A*. Two drills, one at *B* and the other hidden by parts of the machine, are guided by bushings in the plate *C*. As the platen moves upward, the holding fixture is kept in alignment by the two guide pins *D* entering bushings provided for them in a stationary part of the machine.

Upward movement of the platen brings the shuttle into contact with the bushing plate, holding it securely. Further upward movement of the platen brings the bushing plate into contact with the spring *F*, its purpose being to push the bushing plate down as the platen is lowered. After the holes have been drilled the platen is lowered and the holding fixture is moved to the left, where the holes are reamed in a similar operation. The holding fixture is locked in both the drilling and reaming positions by the lever *H*. The holding fixture is moved from one position to the other by mechanism not shown, but the operator has ample time to load and unload it while it is in transit.

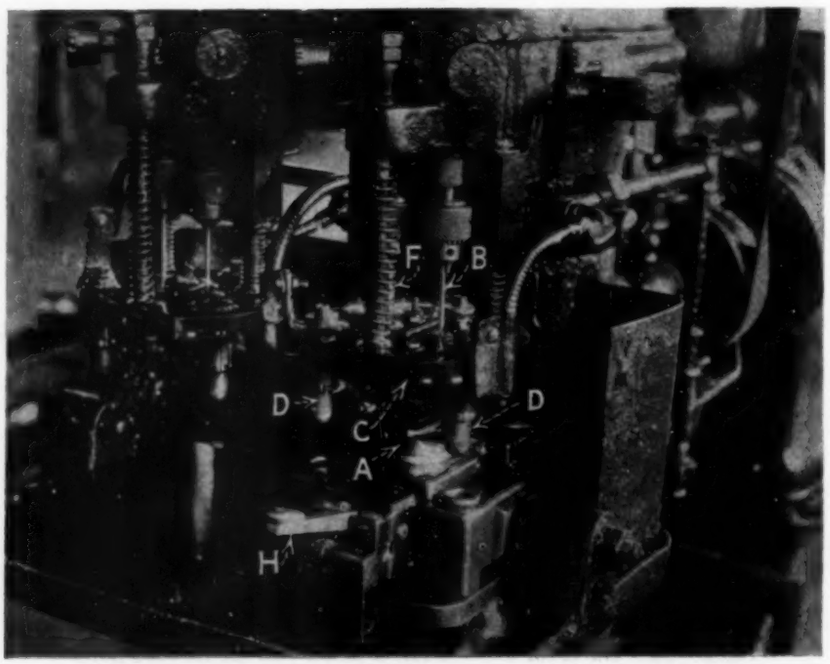


Fig. 2—The shuttle is located in a nest and is securely held by the upward movement of the platen bringing it into contact with the bushing plate

Punch and Die Steels

H. R. LE GRAND
Assistant Editor, American Machinist

Standardized practices of two large plants in the application of die materials can benefit others which have not set up such guides

IN MANY shops there is not sufficient volume of die work to warrant the setting up of standards for the selection of die materials. Also, it is not always possible to find information on what is good practice. But dies constitute an expensive item of cost and one in which there is often much loss, and so it is important to have a guide if waste is to be minimized. For these reasons, the data used by two large manufacturing organizations, whose die problems cover a wide range of work, are reproduced here. In each company, the standards in use have proved helpful in preventing spoiled dies, in reducing inventory of die materials, and in establishing orderly procedure in die design.

The principal factors entering into the selection of materials for punches and dies may be summarized as follows: the kind of material to be press worked; the quantity of parts to be produced; the kind of operation to be performed, such as blanking, forming, and drawing; and the quality requirements of the product such as freedom from burrs, for example, in the case of laminations. Table I shows the general application of steels used for punches and dies and for different operations on various sheet materials. This table shows the practice of the Western Electric Company. It should be understood that although specific information is listed for selection of steels, there are cases where modifications are made so that advantage may be taken of latest developments and, in such cases, the metallurgical organization is consulted. Table X shows some of the die materials in use by the General Electric Company and the general application thereof.

At the Western Electric Company, parts are produced from materials such as brass, nickel silver, phosphor bronze, magnetic iron, cold rolled steel, silicon steel, phenol fiber, rubber and paper. Some of these materials are used in thicknesses ranging from a few thousandths of an inch up to ⅛ in. Since this company's principal product is telephone equipment, the parts punched are, as a rule, held within comparatively close tolerances. This is a necessity both from a standpoint of field service of the apparatus as well as to insure economical assembly.

Standards Essential

The Western Electric Company operates in widely separated locations and as an interchange of tools between plants is essential, standard procedure such as shown in Table I has been evolved to cover a large portion of the tools designed. Experience has shown that relatively few brands of steel will meet the usual demands. In fact, the bulk of steel used falls in the carbon and high-speed steel classifications. As may be noted, by referring to Table I, carbon steel is used for a large portion of the dies which would include those for brass and the softer steels. For the harder or more abrasive materials such as silicon steel, permalloy mica, and high carbon-high chrome, the high-speed steels are used.

Tables II to IX give the specifications of the four carbon steels, the drill rod and five alloy steels which are at this time among the steels considered standard. As indicated when special problems arise, the use of special steels is considered, but most frequently they are solved with one of the alloy steels mentioned.

Thickness of the material principally affects the heat-treatment. Table I shows that for blanking dies a choice of die materials is offered to the designer. For blanking stock both under and over ⅛ in. high-speed steel dies are given the same hardness. For materials more than ⅛ in. thick the carbon steel and the oil-hardening steel dies have increased hardness. Punches for blanking operations are made from high-speed steel or high-carbon, high-chromium steel when the operations are severe, and from the oil-hardening and carbon-steel analyses for work of less severity. The hardness of both the blanking punch and the die are the same when made of high-speed steel, but carbon steel punches are made in a slightly lower hardness range than dies of the same material. In the case of forming tools, however, the dies are mostly left somewhat softer than the punches. For drawing opera-

Close follow-up by management minimizes bad practice, leads the way to better die-shop efficiency

Table I—Die Steels Generally Used and Hardness Recommended

(Courtesy of the Western Electric Company)

Type of Tool	Number of Steel	Hardness Rockwell "C"
Adapters, punch and die	13–15	55–58
Adapters, punch press	19	55–58
Arbors, forming die	11–15	63–66
Arbors, forming die, frail	11–13	53–56
Backing plates, heading	15	55–58
Backing plates, punch and die	13–15	57–60
Blades, cut-off, heading	15	Cutting edge 61–64 Back edge Spring temper
Blades, shear	1 13–15–28	66–64 59–62
Bushings, guide	19	63–66
Bushings, guide post	19	61–64
Bushings, perforator	11–13–15	60–63
Bushings, stripper	11–13–15	60–63
Dies, blanking, stock under $\frac{1}{16}$ in.	1 13–15 25	60–64 60–63 58–62
Dies, blanking, stock over $\frac{1}{16}$ in	1 13–15 25	60–64 62–65 60–64
Dies, blanking, permalloy, silicon steel, mica	1 or 28	60–64
Dies, clipping	13–15	60–63
Dies, drawing, stock under $\frac{1}{16}$ in.	1 13–15	60–64 63–66
stock over $\frac{1}{16}$ in.	1 13–15	60–64 61–64
Dies, embossing	13–15	60–63
Dies, forming, stock under $\frac{1}{16}$ in.	13–15	60–63
stock over $\frac{1}{16}$ in.	13–15	63–66
Dies, heading, straight holes no radius, no cavities	15	62–65
with radius or cavities	15	59–62
with square recess	15	57–60
Dies, hot forming and swaging	5	54–58
Dies, knife edge	15, 23 or 25 28	53–56 52–56
Dies, notching	13–15	62–65
Dies, perforating:		
Brass or steel under $\frac{1}{16}$ in.	13–15	60–63
Brass or steel over $\frac{1}{16}$ in.	13–15	57–60
Bronze under $\frac{1}{16}$ in	13–15	60–63
Bronze over $\frac{1}{16}$ in.	13–15	58–61
Rubber and Permalloy under $\frac{1}{16}$ in.	13–15	60–63
Rubber and Permalloy over $\frac{1}{16}$ in.	13–15	58–61
Dies, shaving	1 13–15	60–64 61–64
Dies, swaging	23	62–66
Draw rings	1 13–15	60–64 62–65
Hammer blocks, swaging	23	62–65
Knock outs	15	57–60
Pads, embossing-die	13–15	60–63
forming die, light work	13–15	57–60
forming die, heavy work	13–15	60–63
spring, for inserting punch	11	57–60
Perforators:		
to $\frac{3}{32}$ in. diam.	1 11 or 13 28	57–61 51–54 60–64
$\frac{3}{32}$ to $\frac{3}{16}$ in.	1 11 or 13 28	57–61 57–60 60–64
$\frac{3}{16}$ in. diam. and over	1 11 or 13–15 28	57–61 60–63 60–64
Perforators for Permalloy	1, 11, 13 or 28	57–60
Perforators for embossing	11 or 13–15	58–61 All heads of perf. & pilot spring temper.
Pilots	11 or 13–15	57–60
Plungers, inserting punch	11 or 13	57–60
Plungers, knock out	11 or 13–15	57–60
Punch, plates	1020 or 13–15	56–59
Punches:		
Blanking, stock under $\frac{1}{16}$ in.	1 or 28 13–15 25	60–64 58–61 60–63
Blanking, stock over $\frac{1}{16}$ in.	1 or 28 13–15 or 25	60–64 60–63
Broaching	13–15	60–63
Clipping	13–15	60–63
Drawing:		
stock under $\frac{1}{16}$ in.	13–15	60–63
stock over $\frac{1}{16}$ in.	13–15	63–66
Embossing	13–15	58–61
Flattening	1, 13–15 or 28	63–66
Forming:		
stock under $\frac{1}{16}$ in.	13–15 25	61–64 60–63
stock over $\frac{1}{16}$ in.	13–15 25	63–66 60–63
Heading	15	58–61
Hot forming	5	56–60
Hot swaging	5	56–60
Inserting, heading	15	57–60
Knife edge	13–15	Spring temper
Notching	13–15	60–63
Perforating, under $\frac{3}{32}$ in.	1 11 or 13	60–64 57–60
$\frac{3}{32}$ in. and over	1 13–15	60–64 60–63
Riveting	11 or 13–15	57–60
Shaving	1 13–15 23	60–64 62–65 61–65
Shearing	13–15	59–62
Staking, heavy-duty, large cross sections	13–15	59–62
Staking, light-duty, small cross sections	13–15	56–59
Swaging and bumping	23	60–64
Push pins	11 or 13–15	56–59
Stops, auto punch and die	13–15	57–60
Stops, finger punch and die	1020	file hard
Strippers	1020 13–15	53–56
Yokes for punch and die	13–19	55–58

Tables II-IX inclusive give the specifications for the steels referred to in Table I

Table II—Carbon Tool Steels Most Frequently Used

		Min.	Max.
Carbon	No. 13	1.20	1.30
	14	1.10	1.19
	15	1.00	1.09
Manganese		0.25	0.40
Silicon		0.10	0.40
Phosphorous		....	0.025
Sulphur		....	0.025
Chromium—None desired		....	0.10
Vanadium—optional		....	0.25

Brinell hardness—Minimum 160; Maximum 190; desired 180. Cleanliness and degree of spheroidization covered by micrographic standards.

Table III—No. 19 Carbon Tool Steel

	Min.	Max.
Carbon	0.90	1.05
Manganese	0.25	0.50
Phosphorous	....	0.04
Sulphur	....	0.05

Brinell hardness—Minimum 160; Maximum 190.

Table IV—No. 11 Carbon Tool Steel Drill Rod

Up to $\frac{7}{8}$ in. in diameter

	Min.	Max.
Carbon	1.17	1.35
Manganese	0.30	0.47
Silicon	0.10	0.25
Phosphorous	....	0.025
Sulphur	....	0.025
Chromium*	....	0.10
Over $\frac{7}{8}$ in. in diameter		
Carbon	0.95	1.05
Manganese	0.30	0.47
Silicon	0.10	0.25
Phosphorous	....	0.025
Sulphur	....	0.025
Chromium*	....	0.10

*None desired.
Steel must be readily machinable.

Table V—No. 1 High Speed Tool Steel

	Min.	Max.
Carbon	0.65	0.75
Manganese	0.10	0.40
Sulphur	....	0.035
Phosphorous	....	0.035
Silicon	0.15	0.35
Chromium	3.50	4.50
Tungsten	17.00	19.00
Vanadium	0.80	1.10

Brinell hardness—Minimum 200; Maximum 245; Desired 230.

Table VI—No. 5 Hot Work Tool Steel

	Min.	Max.
Carbon	0.40	0.50
Manganese	0.15	0.35
Sulphur	....	0.03
Phosphorous	....	0.03
Silicon	0.10	0.30
Chromium	3.00	4.00
Tungsten	10.00	15.50
Vanadium	0.15	0.90

Brinell hardness shall be lower than 248.

Table VII—No. 23 Finishing Steel

	Min.	Max.
Carbon	1.25	1.40
Manganese	0.25	0.35
Silicon	0.15	0.50
Phosphorous	....	0.025
Sulphur	....	0.025
Tungsten	3.50	4.40
Chromium	0.15	0.80
Vanadium	Optional	

Brinell hardness not more than 235.

Table VIII—No. 25 Non-Shrink, Oil-Hardening Tool Steel

	Min.	Max.
Carbon	0.80	0.95
Manganese	1.10	1.30
Silicon	0.20	0.35
Phosphorous	....	0.025
Sulphur	....	0.025
Vanadium	....	....
Chromium	0.40	0.60
Tungsten	0.40	0.60

Brinell hardness below 212 is desired.

Table IX—No. 28 High Carbon, High Chrome Tool Steel

	Min.	Max.
Carbon	2.10	2.60
Manganese	0.20	0.35
Phosphorous	....	0.025
Sulphur	....	0.025
Silicon	0.20	0.50
Chromium	10.00	13.00
Vanadium (optional) but if included	0.05	0.15

Brinell hardness not more than 248.

Table X—General Electric Specifications for Die Materials

Steel	Composition		Application
1 High Carbon Steel	Carbon	1.10	Cutting, forming and drawing dies for low and medium production; material selected because of low cost, good machining qualities and intense hardness. Used for designs not likely to crack or warp excessively when water quenched.
	Manganese	0.25	
	Silicon	0.20	
2 Low-Alloy Oil-Hardening Steel	Carbon	0.85	Cutting, forming and drawing dies and for cold stamping and coining operations that require greater depth of hardness, and better resistance to cracking and warping as compared with Steel No. 1.
	Manganese	0.32	
	Silicon	0.38	
	Chromium	1.67	
	Vanadium	0.06	
	Tungsten	0.56	
3 Air-Hardening High-Carbon High-Chromium	Carbon	1.50	Cutting, forming and drawing dies for highest production or where minimum warpage and danger of cracking in hardening are required. For drawing and forming dies this material is usually furnished in the cast form.
	Manganese	0.30	
	Silicon	0.50	
	Chromium	12.0	
	Vanadium	1.0	
	Molybdenum	1.0	
4 Machine Steel			Low-production dies such as simple push-through types and for various parts of dies where case-hardening material is suitable. The material is treated by the cyanide process when a case less than 15 mils thick will suffice and by the pack-hardening process when greater case depth is necessary.
5 Electric Furnace Cast-Iron	Carbon	3.00	Drawing and forming dies for low production and for die-casting dies for zinc and aluminum alloys.
	Manganese	0.75	
	Silicon	2.00	
	Molybdenum	0.50	
6 High-Carbon Steel	Carbon	0.95	Cold-headed dies.
	Manganese	0.45	
	Silicon	0.35	
7 Chrome-Nickel Molybdenum Steel	Carbon	0.40 to 0.60	Forging and hot-heading dies. The forging die blocks are heat-treated by the manufacturer to specified Brinell hardness ranging from 325 to 425, and the impressions are machined in this treated material.

tions, the hardness of carbon-steel dies decreases with metal thickness, whereas the hardness of the punches increases with the stock thickness.

The type of operation has much to do with the hardness required for press tools. Knife-edge dies and perforating dies are left softer than blanking, drawing or embossing dies to allow sufficient toughness to prevent breaking such delicate tools. The hardness of punches also varies to suit the operation. Carbon-steel punches are left softer than other punches for such work as embossing and heading operations to permit required toughness. The middle range of hardness is applied to blanking, broaching and light drawing punches where some toughness is sacrificed to secure greater hardness. Forming and heavy drawing punches are least likely to break and can be fully hardened to secure the best wear resistance.

Punch Shape Affects the Material

Shape or contour of the punch and of the die opening are often deciding factors in choosing the correct die material. An oil-hardening steel may, for example, be less likely to distort in heat-treating than a carbon steel. When the die is of intricate contour it is common practice to make it in sections to reduce machining costs and to minimize internal stresses resulting from heat-treating. In some cases, where the die is subjected to excessive wear, inserts are used which can be replaced easily. In general, the practice is followed of making the sections and inserts of the same material, the advantage being that there is less liability of the wrong material being used in the making of the parts originally and in the maintenance of them.

The Western Electric Company uses gas and electric furnaces which are equipped with automatic temperature controls and recording pyrometers and with these modern heat-treating facilities, it is not difficult to obtain the desired hardness within a few points on the Rockwell "C" Scale. The procedure for heat-treating punches and dies is determined and specified by competent metallurgists whose duty it is also to see that the temperature controlling and recording equipment is properly maintained. By the standardization of hardening practices, a considerable reduction has been made in losses from distorted, cracked, or otherwise improperly hardened punches and dies.

Science and Practice in Metal Cutting —Discussion

M. P. DALTON
Sevenoaks, England

Referring to Dr. Erich Bickel's article (*AM*—Vol. 78, page 693), where it is stated that the A.D.B. had fixed an arbitrary tool life of 60 min., my experience will be of interest. I consider that the practice in cutting both metals and non-metals is generally similar when efficiently carried out.

Using magazine feed for circular blanks, four holes had to be drilled near the center on the diagonals. The holes were small, all under $\frac{1}{8}$ in. in diameter, and they were countersunk top and bottom. The machine was entirely automatic, and the quantity of blanks unlimited so that long experiment was possible. The top tool was a combined flat drill and two-bladed countersink; the bottom a plain countersink.

The material was a fairly hard (like brass) highly abrasive molded plastic. The machine optimum was reached throughout with the tool as the limiting factor.

Cast steel, 14 per cent tungsten, 18 per cent tungsten, Stellite and Widia were tried. The steels all failed to stand up for the desired time. Stellite and Widia stood up for much longer, but their cost was prohibitive for the work done. As the finished product was very cheap indeed, the increase of tool cost was of considerable importance. For a similar reason, the tungsten steels were rejected as their measure of life beyond that given by cast steel did not justify the extra cost. After standardizing on the original cast steel, an extended trial forced replacement of the tools at approximately hourly intervals. The coincidence between the results of a large scale test on a non-metal product and the arbitrary time limit of the A.D.B. is curious. It almost seems that the A.D.B. limit was not arbitrary.

The two factors of depth and feed cannot be combined without qualification in practice. In experimental work it may be possible; but practically, the use of the combined factor is limited in the workshop by two considerations and perhaps others. Too light a cut will certainly lower the tool life to a disproportionate extent. Too great a depth of cut will mask the tool to a proportionately greater extent and will seriously interfere with heat transfer so that the tool will be damaged quickly. These two limits are common practice. A third factor of enormous importance is not mentioned, and that is the work hardening of the built-up cutting edge. The impact value of the beginning of the cut is of prime importance here and is associated with definite optimum conditions of depth and speed. These points are interesting, but they do not lessen the value of Dr. Bickel's arguments in general shop practice.

When it is considered that the article sets out to present a practical viewpoint, Dr. Bickel is incorrect in stating that the economic optimum means maximum chip production rate. Economic optimum is when chips are produced at the lowest cost per weight unit. Even then, this only applies to roughing cuts. In determining the economic optimum, there are many factors to be considered which Dr. Bickel or the experimenters quoted cannot know. They are the purely local conditions affecting the factory, the machine and the operator. This optimum is fixed scientifically by the shop manager, if he is properly trained. It cannot be done elsewhere than on the spot, and even then much has to be left to individual judgment as to what is the optimum, and this cannot be fixed experimentally. Thus, for instance, a shop may have only one tool within the life of which a definite batch must be produced. Such a case is common. There are often financial or other reasons why no other tool can be obtained. This is the difference between experimental science and scientific application. It is not the job of a laboratory to fix the purely local factor representing the economic best.

Welded Car Trucks

Welding is branching out into new fields. This time it's for truck frames or "bogies." These welded car trucks are built for the Crown Agents for the Colonies and are to be used on the Nigerian Railway. They have been designed to give greatly increased stability with a weight reduction of twenty per cent.

Leipzig's Great Machinery Market

II

K. H. CONDIT
Editor, American Machinist

Additional views of this year's exhibits reflect latest German trends in machine tool construction

LEIPZIG—Final figures on the attendance at the 1935 Technical Fair at Leipsig indicate that it was more successful than the fair of 1934. There was less vacant space in the huge permanent buildings, and more people came to see the exhibits. On the last day, Sunday, so many engineers and factory groups came that the management was at the point of closing the gates to prevent serious trouble from overcrowding. The Wanderer Works, for example, sent 2,000 of their men over from Chemnitz, and they marched in, in a body. Such a demonstration is typical of the sort of spirit to be found in German plants under the Nazi regime.

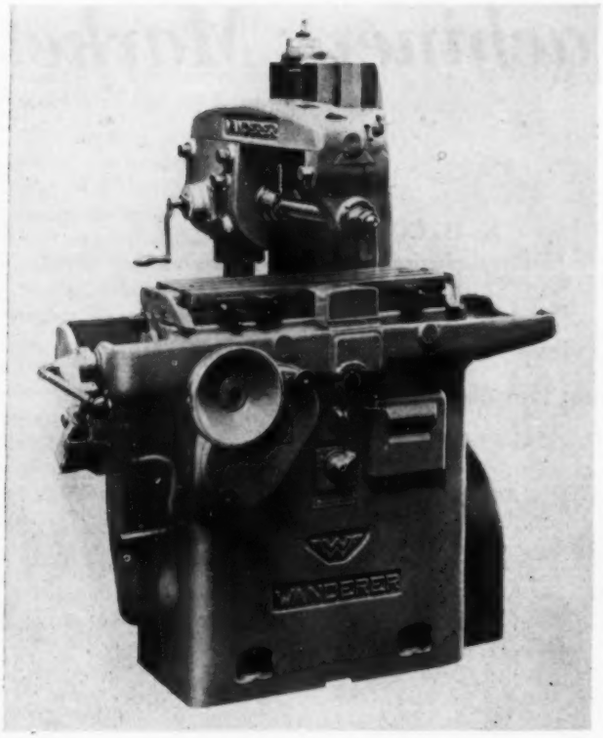
With one exception, the display of engines and compressors, the exhibits in the other halls of the Technical Fair were far less impressive than the machine tool exhibits. German diesel engines have reached a high stage of development, and the new Junkers compressor with its two opposed free pistons is extremely interesting. But the domestic machinery shown is in a different stage of development from our own and shows clearly how different the standards of living in the two countries are. The designs of contractors' machinery also seem to be somewhat behind those of American builders, and the hardware and building equipment show was disappointing to one used to American refinements, particularly in bathrooms.

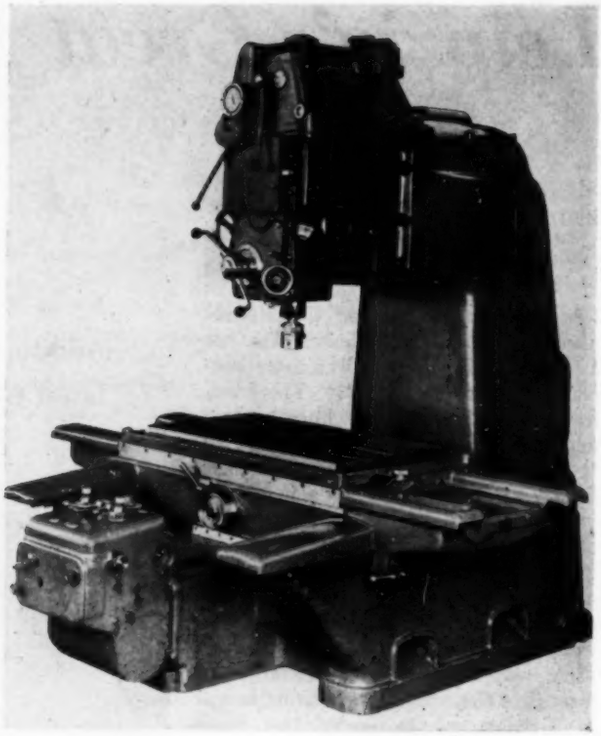
An excellent example of what an engineering society can do to make a constructive contribution at a machinery exhibit, and at the same time advertise itself and its members, was the works management exhibit arranged in a gallery of the machine tool hall by the Association of German Management Engineers, one of the VDI groups. The plan of the exhibit was to follow the product through a plant from raw material receipt to the shipping platform, and to illustrate the different types of control needed at each stage of the process. The apparatus on display was contributed by the makers for this exhibit.

The various factors that must be

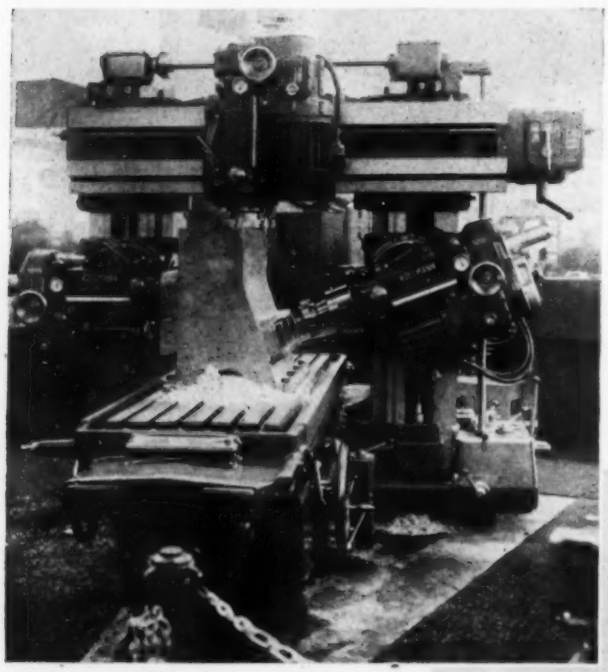
Severe exterior of Hall 9 where machine tools and woodworking machines were to be found

When the crowd really got thick, only the taller machines were visible. Collet & Engelhard is at the left, Waldrich just beyond, several presses in the distance



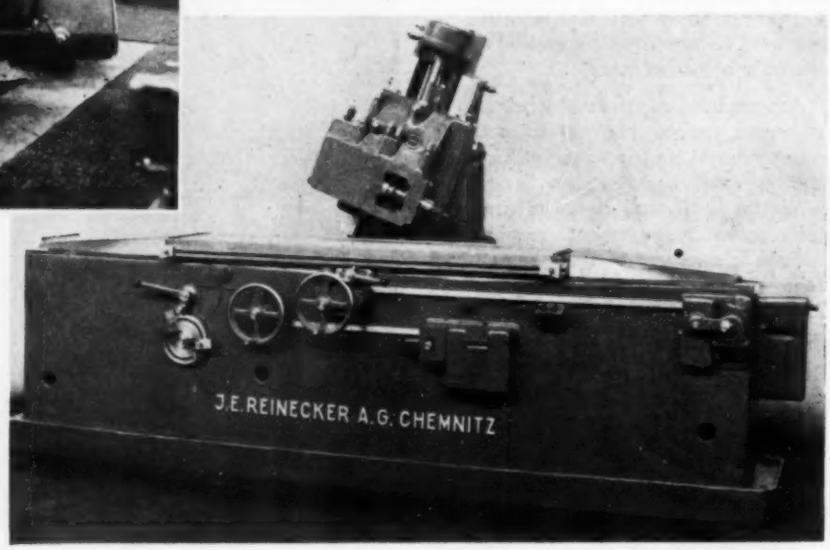


Top left—Wanderer's plain milling machine is a simple, sturdy tool for heavy milling. Change gears give twelve speeds, from 24 to 300 r.p.m. Electrically operated automatic control and higher speed ranges are available. A 3-hp. motor drives the spindle and one of ½ hp. the table

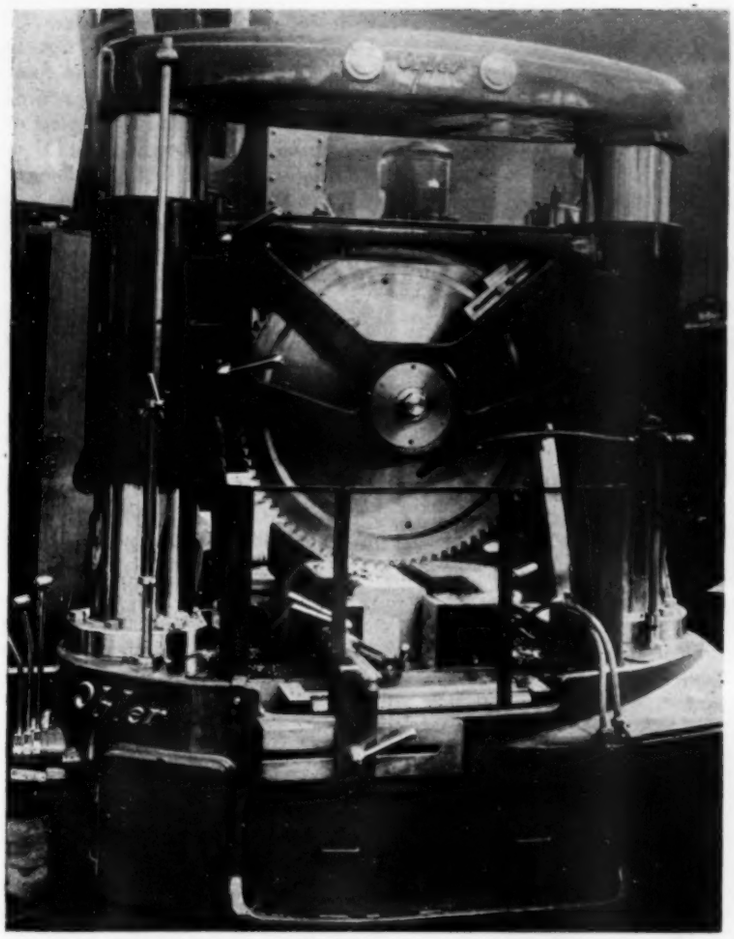


Top right—Lindner jig borer with boring spindle speeds of 50 to 1,900 r.p.m. and with a compound slide traveling on hardened rollers and ways. Setting of the tables is by means of a fine spiral groove scribed in a hardened roller and observed through a microscope. With the aid of the vernier scale readings 0.0001 in. are possible. There is no connection between the measuring system and the table drive

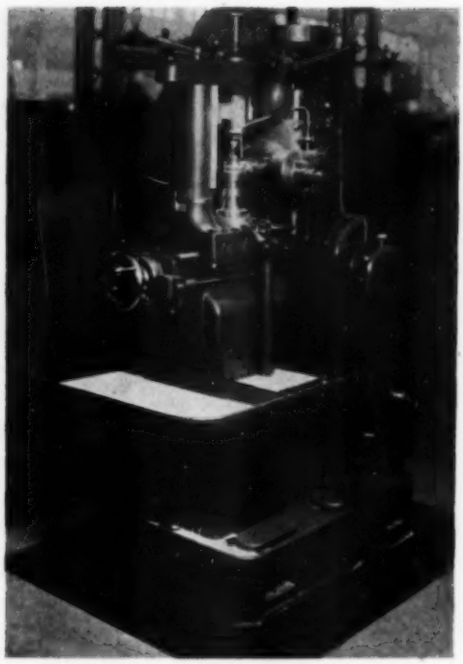
Three-head planer-type milling machine built by Köllmann for a motor block reflects a novel use of flange motors and built-in tachometers



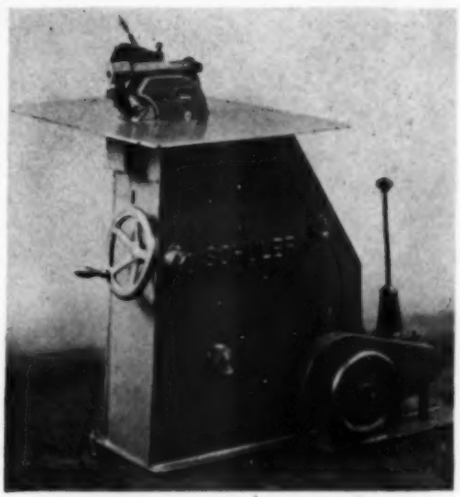
Right — Reinecker's rack miller shows clean design. The milling carriage can be swiveled 30 deg. in the vertical plane to cut skew teeth and 15 deg. in the horizontal plane to cut buttress teeth



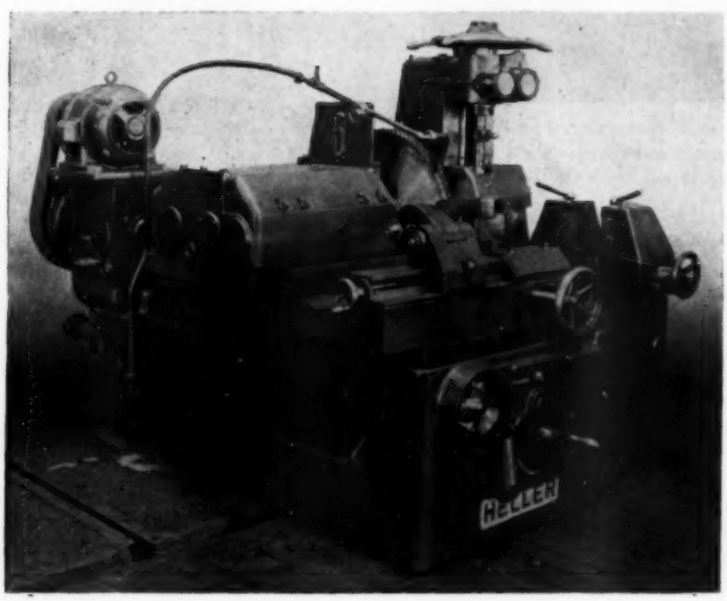
Ohler cold saw, with direct motor drive and sturdy frame, has the stock feed and chuck jaws operated hydraulically. Six saw speeds available, motor control by push buttons



While the essential operating principles of Pfauter hobbers have not been changed in this small machine, the tying together of the frame with an overarm, the use of a flywheel on top, and the built-on work light are improvements



A small Schuler machine for turning up flanges on the edges of sheet metal parts of various shapes and sizes. Note the "joy-stick" control



Heller offers this cold-sawing machine with speeds up to 1,180 ft. per min. for use on non-ferrous metals. Hydraulic automatic feed is employed to cut large quantities of material into pieces of uniform size. Feeds are independent of any heating of the oil

Display of molded plastics, die-castings, portable tools and other products of Robert Bosch A-G in a separate building was one of the most attractive in the whole Technical Fair

This section of the works control equipment exhibit, arranged by the works management engineers, shows measuring instruments used in connection with power services

controlled were listed as power, time, materials, dimensions, quantity, weight and cost. Control of power and time came first, because they are common to all industries.

In the power control section, instruments for measuring steam, gas, water and electricity were arranged in order. Gas motors and pressure-regulators, thermometers and flow meters, thermocouples, pressure and temperature recorders, hydrometers, steam gages and recording meters, water meters, ammeters, voltmeters, CO_2 and flue gas analysis apparatus were all to be found in the proper places. Automatic control systems were illustrated.

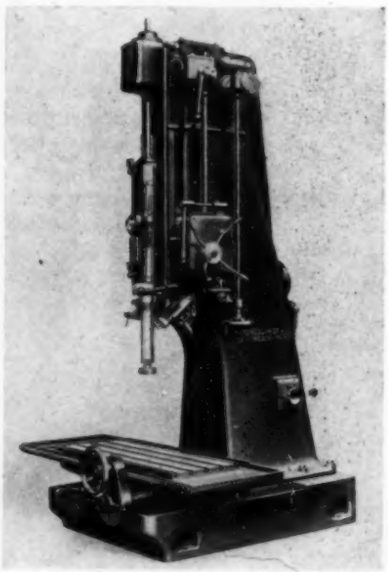
In the time control section were more than twenty varieties of stop watches, watchman's clocks, time clocks, and devices for determining and recording lost time in the shop. At this point the exhibit splits, the left-hand course taking the visitor through material control in the metals industries, the right-hand course leading first through the food industries and then through the textile industries. It will be sufficient here to follow the left-hand course.

First came the physical testing machines for checking tensile and compressive stresses, torsion, fatigue, hardness and so forth. Then a display of X-ray photographs of sections, and then some interesting sheet-metal testing apparatus. The next exhibit contained the usual equipment of a good plant chemical laboratory, including spectroscopic and microscopic apparatus.

Next was dimensional control with a full line of ring and plug and snap gages, indicators, microscopes, gage blocks and counting scale; also internal and external cylindrical gages, thread gages, tachometers (one with a built-in stop watch), etc. In the next space were several brakes and dynamometers and a stroboscope. The division into dimensions, quantity and weight control was not too clear.

Finally there was the section, devoted to cost control, where everything is finally brought together. Charts and forms constituted the major part of this exhibit and the charts particularly were good.

Of the few individual company exhibition buildings, that of Robert Bosch was the most interesting. The exhibits of molded plastics, diecastings, portable electric tools and other Bosch products were well arranged and the rotating display stands added a dynamic touch that attracted attention.



Especially designed for greater precision in machining cylinders is the fine boring machine by Mayer & Schmidt. Carbide tools are used at high speed and fine feed. The capacity is 9½ in. diameter and 21¾ in. depth

EDITORIALS

VOLUME 79 AMERICAN MACHINIST ESTABLISHED 1877 McGRAW-HILL PUBLISHING COMPANY, INC. NUMBER 8

K. H. CONDIT F. H. COLVIN
EDITORS

The New NRA

FOR A WHILE, NRA seemed likely to expire through lack of active sponsorship. Congress was hostile, the administration apathetic and business divided upon its future. Its only vociferous friends were within the Recovery Administration itself.

But the President, in saying that NRA was no "Orphan Annie," came out flatly for its continuance. Senator Pat Harrison put the issue squarely up to Congress and the country by introducing a bill to extend this form of "recovery" legislation for two years "to head off strikes."

Superficially, the proposed measure is a well arranged codification of the old. All codes would be extended automatically for ninety days beyond the expiration of the present act, pending revision.

Closer study, however, discloses important modifications of the present law to which business will not willingly submit. Codes in effect on June 16 may be reopened at the will of the President, who will have the right to cancel, modify, change codes or orders without consent of the industry. This includes the power to impose "limited" codes, presumably chiefly labor provisions, which may contain the wage differentials for skilled labor fought successfully in the old code hearings. Companies will be required to keep special books covering their operations and to open these books to government inspection. The Federal Trade Commission would be given new power over industry, as a tool for investigations. New enforcement rules would make it easy for disgruntled employees to bring suits against industrial units.

Section 7a, which is commonly supposed to have been left unchanged, contains a joker in that the phrase "shall contain the following conditions" has been altered to read "shall contain the following statement of rights of employees, which are hereby declared and affirmed." Thus the bill becomes a labor bill of rights.

IN SHORT, in the terms of the Harrison bill, the heralded "partnership" between government and business has disappeared. Industry would be subjected to rigid imposition of executive edicts, and all privacy of operation would be violated. This bill adds another to the long list that private enterprise must fight vigorously if it is to avoid a new set of onerous restrictions.

Register emphatically your objections with your congressmen and senators.

Patent Pooling

IT SEEMS to be the current style to start organized campaigns against our business or governmental institutions. The usual technique is to discover an "abuse," to magnify it, to generalize upon it, and then to create the impression that a mysterious but unseen group is exerting a malignant influence detrimental to our economic life.

An attack of this kind is now being waged against our patent system by an organization calling itself the American Economic Foundation, "organized to secure for the American people the economic benefits of science and industry by opposing the abuses of patent monopolies, patent pools and royalty dictatorship in restraint of trade." The Foundation seeks to enlist support on the basis that "unfair patent monopolies are insidious devices for exercising monopolistic control over markets and prices," that "certain large manufacturers who control patent pool monopolies are veritable dictators.

Patents are monopolies—practically the only ones receiving full government sanction. They are granted as a direct reward for invention, so that a person who makes a practical contribution to industry may enjoy its benefits for a limited term of years. The successful objective of the system is to eliminate secret processes which, historically, have been the alternative to protective patents. After the patent expires, the fruits of the invention become available to all who choose to use it.

We have grown to believe that in this country mechanical progress, with its accompanying increase in living standards, has been aided to a great degree by American inventiveness, fostered by adequate patent protection. It is true the inventor has not always commercialized his own patent; he has often assigned it to a corporation and, in some instances, the corporation has licensed other firms.

Wide application is just as important as patents themselves in promoting technical and industrial advance. The very pools and cross licenses, denounced by the Foundation, have made possible this wide usage. Small inventors can seldom develop their patents on a large scale and, if they are not developed, the consuming public loses their advantages.

In the automobile industry alone, patent pooling has helped to make it possible for the public to buy better cars at lower prices. Many other specific examples can be cited. But the circular letter released by the Foundation, soliciting support, does not give one fact in support of its broad assertions condemning the interchange of inventions. Destructive sniping of this kind casts over the sponsoring organization the suspicion that it is just another economic racket.

. CHIPS .

Washington—Work Relief Measure, little changed and carrying original sum of $4,880,000,000, finally passes both houses of Congress and is signed by the President . . . House Ways and Means Committee reports out modified social security omnibus bill which will require new taxes of about $800,000,000 in 1937, and at least $1,800,000,000 by 1949 . . . "Pink slip" clause calling for publication of income tax returns is repealed by Senate . . . House starts to modify the McSwain War Profits bill which authorizes the President to freeze prices, rents, salaries, etc., in time of war and to tax away excess profits . . . Senator Harrison introduces bill for 2-year extension of NRA which contains certain potentially dangerous changes . . . Roosevelt returns from fishing trip.

Foreign—France moves troops to the northern frontier . . . European leaders exchange visits in efforts to clear the air and avoid moves or misunderstandings that might lead to conflict . . . Italian mobilization is continued . . . Nazis take over state judicial functions in further step toward centralization of authority . . . Prices rise in Belgium as belga is devalued 28 per cent . . . Chile and Argentina invite U. S. to join them in ending Chaco war . . . Planes en route to Bolivia are grounded in Chile when State Department discovers their destination and prevents U. S. pilots from flying them farther . . . Nazis fail to win Danzig election.

Finance—Break in gold block threatened by Belgian bitterness toward France . . . Banks report gains in deposits and resources . . . RFC loan repayments close to $2,700,000,000 . . . March income tax receipts 40 per cent higher than in 1934 . . . Treasury making encouraging progress in refunding Liberty bonds at lower rates, another call is expected shortly . . . Bank clearings up for fifth week in succession.

Industry—Business divided in attitude toward NRA continuance, textile industry leads those who favor it, heavy industries generally opposed . . . Wagner and 30-hour-week bills hold great potential danger to industry, opposition to them is stiffening . . . Troubles of Hupp Motor Car climaxed by strike of A F of L union members . . . Textile union protests NRA code production restriction.

Indicators—Carloadings rise and exceed record of a year ago . . . Steel production recovers somewhat . . . Electric power output off slightly . . . *Business Week's* index steady.

Harrison Bill for New NRA Contains Many Labor Jokers

WASHINGTON—While industry presents a divided front on Capitol Hill, the labor lobby continues vigorously to push its demands. It is behind the Black 30-Hour Week bill, the Wagner Labor Relations bill and the Harrison NRA bill. Business men know they do not want any part of the first two, but on NRA there is a great diversity of opinion.

In general, the machinery and other heavy industries are against continuance of NRA. Sweated labor by small independent groups was not a problem with them. They received little benefit from the fair practice provisions in their codes, and the promised opportunity for self-government proved largely a myth. Their wage scales were usually in excess of the code minimums.

However, this group quickly discovered that NRA raised a crop of labor agitators among their employees. Their open shop set-up was threatened, and their industrial peace violated. They naturally see little merit in a statute that has brought nothing but trouble.

On the other hand, certain industries, where price cutting had been flagrant, sweated labor common and lack of leadership evident, found a new working basis in NRA. This group is typified by the textile, lumber and coal industries. Both they and their workers found good in NRA, and in general, they are for its extension.

A big body of employers, between these two groups, are apathetic—they will accept a new NRA, but if it should pass out of the picture, they would not raise a hand to save it. They do not see in the renewal of the Recovery Act a compromise that might save them from the Black bill, as it did two years ago, and perhaps from the Wagner bill as well.

There is some color to the belief that labor may be willing to accept administration endorsement for the Wagner bill as pay for removing pressure from the Black bill. It is likely that the administration would be glad to see both shelved if NRA were extended with Section 7a intact. This is not satisfactory to labor.

Exports of Machinery During February, 1935

	February 1935	January 1935	February 1934
Electrical machinery	$5,206,548	$5,489,207	$4,295,618
Power generating machinery (except automotive and electric)	570,995	617,406	365,395
Construction and conveying machinery	479,274	532,755	407,661
Mining, well and pumping machinery	2,108,730	2,178,156	1,393,850
Power-driven, metal-working machinery	1,606,668	1,430,974	1,705,183
Other metal-working machinery	155,688	166,878	131,965
Textile machinery	422,644	522,315	704,855

Exports of Metal-Working Machinery During 1935

	February 1935	January 1935	February 1934
Engine lathes	$40,236	$32,054	$110,341
Turret lathes	77,624	38,239	66,376
Other lathes	39,445	44,426	52,997
Vertical boring mills and chucking machines	67,250	27,832	48,493
Thread cutting and automatic screw machines	76,120	42,997	57,791
Knee and column type milling machines	67,963	46,775	40,198
Other milling machines	101,862	75,554	142,016
Gear cutting machines	66,468	70,909	186,916
Vertical drilling machines	11,890	65	25,222
Radial drilling machines	10,500	11,274	35,516
Other drilling machines	66,521	37,261	65,524
Planers and shapers	18,604	21,230	5,383
Surface grinding machines	37,757	52,095	55,075
External cylindrical grinding machines	57,892	62,807	102,238
Internal grinding machines	80,073	51,201	128,724
Tool grinding, cutter grinding, and universal grinding machines	167,606	65,524	71,094
Other metal-grinding machines	18,791	34,008	55,610
Sheet and plate metal-working machines	81,082	151,453	153,723
Forging machinery	125,422	243,664	45,118
Rolling mill machinery	141,685	105,280	17,538
Foundry and molding equipment	57,222	27,080	31,098
Other power-driven metal-working machinery and parts	194,652	189,246	208,192

Other Metal-Working Machinery

Pneumatic portable tools	52,394	50,805	40,895
Other portable and hand or foot operated metal-working machines and parts	46,852	57,562	32,060
Chucks for machine tools	11,612	7,898	5,904
Machine operated pipe and thread cutters, stocks, dies, taps and other machine-operated cutting tools	26,267	25,033	30,874
Other metal-working machine tools	18,563	25,580	22,232

How much old equipment will *American Machinist's* Inventory show?		
In 1925	—	44 per cent
In 1930	—	48 per cent
1935	—	?

There is more real sentiment for a measure to cut hours than for the Wagner bill, and labor leaders know this. Hence they desire to use it as a club to get what else they want. Obviously, the Black idea of hour cutting does not appeal to men who make their living by fighting for labor's demands. If the government gives labor everything it wants by law, there is less point in paying union dues for big salaries and expense accounts to union officials. So, down in their hearts, they are more interested in the Wagner measure than the Black.

Up to Business

The administration seems to believe that it is up to business to seek a renewal of NRA on the basis that if it does not it may get something worse. Certain industrialists believe this and are planning to organize business support for re-enactment of the recovery act. But they do not mean the bill introduced by Senator Pat Harrison, which while following the general thought of the old NIRA, includes some important innovations.

For instance, the original act was justified on the basis that it met an emergency. The new act, in addition, states as its purpose "to prevent the recurrence of such emergencies." On this ground, it is not limited to the present emergency.

The bill, as presented, refers to minimum wages throughout. Actually what NRA has done in the past is to set minimum wage *rates*, the total wage varying with the hours worked. The use of "minimum wage" opens the door to guaranteed weekly or annual payments to labor.

Under the current legislation, the President can approve of code authorities or committees set up under codes, but by the terms of the Harrison bill he can provide such committees. This is another important distinction.

The new bill gives an extremely broad definition of interstate commerce so as to bring practically every form of business enterprise under its scope. This would be vital were it not for the fact that the definition that sticks will

eventually be determined by the Supreme Court.

"The President may as a condition of his approval of any such code, impose such conditions (including requirements for the making of reports and the keeping of books and records and the examination thereof) for the protection of consumers, competitors, employees and others . . . "

This clause is full of potential dynamite. It makes possible fishing expeditions into all affairs of any business. Though ostensibly drafted to enforce compliance, it is so broad that it opens the way to most any sort of governmental investigation or recrimination.

When the present codes were drawn up most industrial groups, while submitting to a minimum wage clause, fought successfully the complete wage scales which labor leaders would have imposed. However, in the bill presented, "The minimum wages so provided for may be differentiated according to experience or skill of the operators, locality of employment or other applicable considerations . . ." This would appear to legalize a move to fix a minimum wage for each class of labor in each industry.

Although the changes in Section 7a are slight, they are potentially important. The old 7a read: "Every code of fair competition or agreement approved, prescribed or entered into under this title shall contain the following conditions," and then followed the familiar terms on collective bargaining. The new bill substitutes for the word "conditions," the phrase "statement of rights of employees, which are hereby declared and affirmed." "Conditions" admits of all conditions of employment, including rights of employers as well as rights of employees. Under this interpretation, the much discussed "merit clause" was incorporated in the automobile code, stating employers' right to select employees according to certain principles. But under the wording of the Harrison bill, employees' rights are declared to the exclusion of the employers; a trick of wording perhaps, but apparently intentional and one which may have far reaching consequences.

What
Federal Reserve District
has the greatest concentration
of metal-working machinery?

If you're not sure,
see American Machinist
on April 24

The proposed extension of NRA would, by implication, legalize the boycott program and the rather involved means now used of enforcing it. Government's discrimination in placing orders and its encouragement of similar discrimination by individuals against those who do not fly the "Blue Eagle" is of doubtful constitutionality. The requirement that all suppliers to the government file certificates of compliance for themselves and for their suppliers is in itself a form of licensing. A more American method of procedure would be to assume that bidders for government contracts were complying with the law and by judicial action to proceed against violators.

***Perfect Draw*—Inside halves of the right and left Pontaic front fenders are formed in a single draw. After stamping they are cut in two and welded to the outside halves, with a saving in material and die cost.**

Foundry Machine Orders Dip Sharply in February

With an index of 74.2 for the month of February, as compared to 86.6 for January, foundry equipment orders showed a decline of over 14 per cent. They are, however, well above the level for February, 1934, when the index was 65.8.

Shipments were higher in February, with an index of 85.1, as compared to 76.2 in January and 42.9 a year ago. Unfilled orders fell off to 57.7 from 69.2 last month and were only slightly above February, 1934, when the index was 56.3.

The three months' average of gross orders also showed a loss, dropping to 76.4 as contrasted to 78.0 for January and 48.9 for last year. These figures are based on the returns of twenty-two manufacturers to the Foundry Equipment Manufacturers Association.

Westinghouse Gets Large Navy Order

Receipt of a contract from the United States Navy Department amounting to approximately $1,750,000 for electrical equipment for eighteen 1,500-ton destroyers, has been announced by the Westinghouse Electric & Manufacturing Co. This equipment consists of two turbo-generator sets, regulators and switchboards, which are to be installed in the new vessels now under construction in the United States navy yards throughout the country. All of this apparatus will be manufactured at Westinghouse plants.

Auto Sales and Output Climb But Tool Shops Hit Low Point

DETROIT—From present indications, March output will cross the 400,000 mark. February factory sales to dealers in the United States was 340,544 and, including Canadian output, 358,658. The first three months of this year will show an output above one million cars, a figure which was not equalled last year till toward the last part of April. The schedule for the present month is expected to be better than for March; Ford production at 6,000 per day is still going up and Chevrolet is just getting into full swing with an anticipated output of 125,000 and with 100,000 unfilled orders on hand.

Suppliers' schedules are not as accurate a guide to assembly schedules this year as they were in 1934, since banks of many parts are maintained 30 days ahead of assembly. Last year parts were scheduled within a few days of the final assembly. May releases imply production at the current level; June plans in some cases anticipate little let-down in that month. However, this is tentative, depending upon sales in April and early May. Schedules for releases are ordinarily issued monthly, but later revisions frequently keep purchasing departments busy changing instructions to suppliers.

Although used car inventories are increasing, there is no let-down in retail sales of new cars. Wayne County (Detroit) sales for the week ended March 28, however, were 2,651 as compared with 2,881 for the previous week. New highs in retail deliveries are being reported. For the week ending March 23, Chrysler dealers delivered 15,696 cars, breaking the previous weekly record made September 1 last year. Olds, with a production of slightly better than 900 per day, made an all-time high the second ten days of March with 5,687 sales, bettering the 1929 peak by 11.5 per cent. Pontiac, for the second ten days of March, delivered 5,334 cars which has been bettered only once since 1929. For the week ending March 23, Dodge delivered 326 more units than in the previous week. For the first twelve weeks of 1935 more cars were sold by Dodge dealers than in the first twelve weeks in the company's history. For the same period Plymouth sold 6.6 per cent more cars than the previous week. Preliminary estimates place March sales at 240,000.

The Bureau of Foreign and Domestic Commerce estimates an increase in retail financing of 155 per cent for February over the same month last year, and a 28 per cent increase over January of this year. The same authority states that February sales increased 42 per cent over January, in contrast with the usual increase of 23 per cent. For the past fourteen years the main selling period has run from March to July, inclusive, with the months of April and May the two peak months. In 1933 and 1934 the peak months came in July. The main selling season, based on normal expectations, is then before the industry. Plans are in evidence to increase the tempo during the coming period. General Motors has a spring showing of its lines in the 51 leading cities of the country starting April 6.

The increase in used car inventories will need to be watched especially in view of the anticipated fall introduction of new models. The same is true of production schedules; the plan apparently is to taper off toward the end of the peak season by drawing on the banks of parts currently being built up.

Tools and Equipment

Last year the tool business peak was about over in February, with layoffs in April ushering in a rather unsatisfactory latter half. Now more inquiries are in evidence, and while there has been somewhat of a lull for the past four weeks, steadier business for the year is anticipated. Some summer introductions with chassis and motor changes are responsible together with the pressure for cost reduction and strength coming from other sections of the country. Conditions are improved to the point that some makers are becoming more selective by bidding with a profit margin on items formerly sold at a loss and taking the chance of losing the order.

Survey shows that rates of pay for

• INDUSTRIAL REVIEW •

• Although there are several "soft" spots machinery and machine tool sales for March held up rather well. Dealers have closed orders that originated as far back as 1930 and new inquiries are continually coming in. There is a general feeling that business would be far better if business men could get over the apprehension that is caused by political jockeying in Washington. Passage of the Work Relief Bill is expected to stimulate activity not later than next fall.

• From all three of the big centers on the Atlantic Seaboard comes word that business is better. Lack of confidence is mentioned as an adverse factor but orders are well distributed and diversified and April orders are likely to be at least as good as those of March. Pittsburgh business has held up well under discouraging handicaps although it is far from what it should be. Orders are generally for single units.

• March business in Cleveland was off slightly. While most of the metal-working plants are rather slack some few are going at rates above the peaks of '29. Detroit reports a slowing down both in machine tool orders and in the supply business. Opinion differs as to whether this drop is temporary or will continue through the summer.

• In Cincinnati the supply business has been active but machine tool orders are quiet. Several important deals are hanging fire. The same story comes from St. Louis where it is feared that a seasonal recession has started. Orders have been fairly good up to the last week or so.

• Small tool business in Chicago is picking up and inquiries for machine tools are vigorous. Orders have held up well and distributors confidently expect April business to run well ahead of March. Possibility that some of the reform legislation may not get through this session is looked upon as a favorable factor. March was better in Milwaukee and indications are that April will run ahead of it or at least equal it. On the Pacific Coast the threat of another marine strike has effectually dampened business enthusiasm. If it does not materialize the improvement expected during the spring is likely to occur during the summer months.

tool and die makers are higher in this area than in other parts of the country. Some disadvantage in hours as compared with captive tool and die departments is borne by independent shops. However, the greater familiarity with automotive needs and the preponderance of some kinds of die making machinery have enabled shops here to offset these disadvantages. The difficulty with die work farmed out last year as a result of the strike in this area was largely responsible for the delays and high costs on 1934 models. The uncertainty in NRA administration due to doubt as to its future is a hinderance at present.

Die shops are now at the lowest point of activity since last August. Quotations currently being made lead to the expectation that improvement will be felt by the middle or last of April. With activity at a low ebb labor troubles are non-existent.

Inquiries for machinery are also on the upgrade and are coming largely from suppliers for additional capacity with assembly plants not far enough along on new plans to affect the situation to any marked extent. Difficulty in securing deliveries on machinery purchased due to code limitations on hours is currently reported.

What division of the metal-working industry has the most equipment?

Look for the answer in our next number—April 24

Evidence refuting the charge made in the NRA report on the automobile industry that men above 40 are discriminated against is offered by Pontiac and Buick; at the former plant 25 per cent of the number of workers on the current payroll is stated to be over 40 years of age and 48.8 per cent at the latter.

A new development in the form of increased glass-making capacity is announced for the Ford Motor Co. The $3,000,000 investment required will increase to $23,000,000 the expenditures for expansion by this company since last fall. The new unit, to be in operation next winter, will furnish only a part of the requirements. The Dodge truck plant is to be expanded by the addition of 55,296 sq.ft. of floor space to permit rearrangement of machining equipment and the lengthening of the assembly line.

MAPI Completes Survey Covering Potential Machinery Requirements

A total of $18,574,632,000 in pent-up purchasing for six machinery groups is disclosed by final figures for the survey just completed by the Machinery and Allied Products Institute. Itemized figures are given in the accompanying table.

The MAPI survey was made directly through the members of its 58 member trade associations, each of which covers a separate industry and is representative of at least 80 to 90 per cent of industry production. Details concerning needed machinery requirements were contributed through the use of a survey form covering type of machinery and cost. Quotations as to cost were given, practically in all instances, specifically in dollars and cents and machines were itemized in many cases by name or type, capacity and catalog or design number. Detailed completion of the forms made it fully evident that industrial executives are well impressed with the economic need of replacement. It is also significant that while the survey form did not require company name, suggesting that identification be made instead by industry, companies almost without exception revealed their names.

These figures take no account of the dammed up flood of business existing in industries apart from the machinery industries. They do not include, for example, the broad equipment needs in other durable goods industries such as housing for 1,000,000 families, necessary rehabilitation of 16,000,000 homes, requirements for industrial housing estimated at $1,000,000,000 and other construction needs, all of which alone are variously estimated at $11,000,000,000 and more.

The total disclosed by these estimates approximates three-fourths of the official valuation of all Class I railroads in the United States. It is equivalent, in round numbers, to nearly the full amount collected in taxes by the government—federal, state, county, city, town, village and district—for two full years. It is half again as much as the accumulated deficits in the national treasury since the depression began. It is nearly four times as much as the tremendous total just voted by Congress for public works and relief during the coming fiscal year.

India Increases Imports of American Machinery

Total imports of American machinery into India during 1934 were valued at 10,323,722 rupees, compared with 7,832,148 rupees in 1933, according to Trade Commissioner George C. Howard. The rupee in 1934 was valued at 38 cents and in 1933 at 32 cents. United States' share in India's machinery trade rose from 6 per cent in 1933 to 9 per cent in 1934.

India's aggregate machinery import trade in 1934 was valued at 117,500,000 rupees, a decline of 7,000,000 rupees as compared with 1933. However, with the single exception of sugar machinery, all items in this class showed appreciable improvement in 1934 over the preceding year. Textile machinery was the outstanding item, accounting for 25 per cent of India's total machinery imports.

House Sub-Committee Gives Up Army Plans

Chairman Lister Hill, of the House Military Affairs sub-committee, says that his group will abandon efforts to obtain $405,000,000 for army modernization and mechanization. This decision was reached after the Senate had inserted in the works relief bill an amendment which would preclude the expenditure of any of the $4,880,000,000 fund for military construction. The army modernization plan was submitted to Congress several months ago by General Douglas MacArthur.

Potential Machinery Requirements
***All Industry**

Item	Requirements	Percent of Total
Agricultural implements	$731,840,500	3.94
Electrical machinery and apparatus	6,060,902,423	32.63
Engines, turbines, tractors and water wheels	1,203,636,153	6.48
Foundry and machine shop products	7,299,830,376	39.30
Machine tools	724,410,648	3.90
All other machinery	2,554,011,900	13.75
Total	$18,574,632,000	100.00%

Gray Iron Founders to Meet in Cincinnati

On Thursday and Friday, June 6 and 7, the Gray Iron Foundry Industry will meet at the Hotel Gibson, Cincinnati. This city was chosen because of its location in relation to various foundry centers. The first day will be devoted to discussions of outstanding questions in the industry, together with a luncheon at noon and a banquet that evening. The second day will be devoted to a business meeting and meetings for groups having special interests.

Dealer Committees to Meet in Cleveland

A joint meeting of the Executive Committee and of the Show Committee of the Associated Machine Tool Dealers has been called by W. F. McCarthy, president. It will be held in Cleveland on April 23, and will take the place of the usual spring meeting of the whole organization.

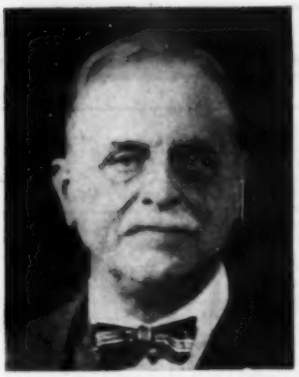
• PERSONALS •

H. W. CALDWELL is now president of the Sterling Grinding Wheel Co., Tiffin, Ohio. Other officers are: ARTHUR E. TULK, vice-president and general manager; ARTHUR W. CURTAS, vice-president, and SAMUEL RUSOFF, works manager.

R. SHANNON has been made manager of manufacturing, and N. A. MEARS, manager of materials control, both reporting to the vice-president in charge of manufacturing for the RCA-Victor Division, according to an announcement by G. K. THROCKMORTON, executive vice-president of the RCA Manufacturing Company. Mr. Shannon was formerly manager of manufacturing at the Harrison, N. J., RCA Radio Tube Plant. Mr. Mears was formerly general purchasing agent for RCA-Victor, and prior to that was plant manager for the Chicago Forging & Manufacturing Co.

W. H. STARING has become president of the Automatic Voting Machine Co., Jamestown, N. Y. He was formerly a director and treasurer of the Aetna Rubber Co., Cleveland, Ohio.

RICHARD L. WHITE, treasurer of Landers, Frary & Clark, Co., New Britain, Conn., has also been elected treasurer of the Goss & DeLeeuw Co., New Britain, Conn.



DR. ELIHU THOMPSON

DR. ELIHU THOMPSON, pioneer in resistance welding, arc lighting and a.c. distribution, was recently awarded the medal of honor of the Verein Deutscher Ingenieure, the outstanding award of the German engineering profession. The medal was conferred on the anniversary of his 82nd birthday.

L. V. REESE has become assistant secretary of the American Engineering Council in Washington, and will assist the executive secretary, FREDERICK M. FEIKER in carrying out the enlarged program voted at the recent annual meeting. Mr. Reese previously had been with the Federal Emergency Relief Administration.

J. D. WISE, executive secretary of the Foundry Equipment Manufacturers' Association in Cleveland, has resigned to become assistant to the vice-president of the Panghorn Corporation, Hagerstown, Md., manufacturers of dust-collecting equipment.

K. H. CRUMRINE has joined the sales engineering staff of the Sterling-French Machinery Co., Detroit. Mr. Crumrine was formerly Detroit sales representative for the Sundstrand Machine Tool Co., of Rockford, Ill., and will continue selling Sundstrand products in his new connection.

GEORGE P. SPEAR, general manager of the Corbin Screw Corp., division of the American Hardware Corp., has resigned. He has been succeeded by JOHN S. BLACK.

FORD L. GRIFFITH has been made director of purchases for the Auburn Automobile Co., to succeed HARRY DUNN who died recently.

M. A. BECKMANN, works manager of Aluminum Industries, Inc., was elected a director at the annual meeting. Mr. Beckmann succeeds to the vacancy caused by the death of H. J. BECK, former vice-president and assistant treasurer.

CHARLES L. TAYLOR, president of Taylor & Fenn Co., Hartford, Conn., has been elected a member of the board of the Landers, Frary & Clark Co.

ALFRED K. MARTIN, vice-president of the Ludlum Steel Co., has resigned to become vice-president, director and chief engineer of the Forging and Casting Corp., Ferndale, Mich.

C. B. NOLTE, president of the Robert W. Hunt Co., Chicago, engineering inspection organization, has resigned to become president of the Crane Co., Chicago. He has been succeeded by JAMES C. OGDEN, formerly, vice-president.

• OBITUARIES •

FRANK L. MORSE, 70, president of the Morse Chain Co., died March 25 at Orlando, Fla. With his brother, Mr. Morse founded the Morse Chain Co., of Ithaca and Detroit, and up to four years ago was active in its development.

LOUIS MENDELSSOHN, former official of the Fisher Body Corp., died March 28, at the age of 81. He served as director, treasurer and chairman of the corporation until 1926.

AMOS CHRISTMAN, who recently became manager of the Northampton (Conn.) Cutlery Co., died March 31, Previously Mr. Christman was superintendent of Factory B of the International Silver Co.

• BUSINESS ITEMS •

The Norton Co., Worcester, Mass., has made the following changes in its sales organization: WALLACE T. MONTAGUE, manager of sales planning and development; W. R. MOORE, sales manager having charge of sales of wheels, grain, pulp stones, refractories, floors and boron carbide; E. C. HUGHES, as assistant sales manager, will assist Mr. Moore in wheel, grain and pulp stone sales, and R. KIRKPATRICK, as assistant sales manager will assist him with refractories, floors, and boron carbide sales. R. M. JOHNSON continues as sales engineer. H. A. CLARK continues as general sales manager, and W. L. NEILSON, as vice-president in charge of sales.

THOMAS PROSSER & SON, New York., importers and distributors of Widia cemented carbides, have opened a Detroit office at 7310 Woodward Ave., with E. R. S. REEDER as district manager.

• MEETINGS •

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual meeting, May 14–15. Penn-Lincoln Hotel, Wilkinsburg, Pa. J. C. McQUISTON, manager-secretary, Penn-Lincoln Hotel, Wilkinsburg, Pa.

AMERICAN MANAGEMENT ASSOCIATION. Joint conference of the Job Order and Mass Production Divisions, April 18–19. Hotel Statler, Cleveland. American Management Association, 20 Vesey St., New York, N. Y.

NATIONAL METAL TRADES ASSOCIATION. Annual meeting, May 15–16. Hotel Cleveland, Cleveland, Ohio. HOMER D. SAYRE, secretary, Peoples Gas Bldg., Chicago, Ill.

AMERICAN WELDING SOCIETY. Annual meeting, April 25. Engineering Societies Bldg., New York City. M. M. KELLY, secretary, 29 West 39th St., New York, N. Y.

UNITED STATES CHAMBER OF COMMERCE. Annual meeting, April 29–May 2. Washington, D. C.

Corporation Reports

Company	1934 Earnings	1933 Earnings
Aero Supply Mfg. Co	*d*$34,909	*d*$20,908
Advance-Rumley Co., Inc	*d*$41,307	*d*$51,041
Allis-Chalmers Mfg. Co	*d*$1,039,406	*d*$2,893,905
Aluminum Goods Mfg. Co	$551,165	$352,735
American Machine & Foundry Co	$1,110,433	$716,909
Bendix Aviation Corp	$1,903,120	$1,242,891
Boeing Airplane Co	**d*$225,977	
Briggs Mfg Co	$5,121,625	
Chicago Pneumatic Tool Co	$412,623	$93,090
Colt Patent Fire Arms Mfg. Co	$577,824	$675,132
Curtiss-Wright Corp	$359,736	
Doehler Die Casting Co	$460,550	$232,933
Easy Washing Machine Co	*d*$18,247	$312,670
Electric Boat Co	$339,948	$38,185
Federal Motor Truck Co	$36,062	*d*$165,062
Gorham Mfg. Co	$214,292	
International Cigar Machinery Co	$1,279,655	$1,248,651
Marlin-Rockwell Corp	$538,258	$110,535
Moto Meter Gauge & Equipment Corp	$360,432	$150,666
North American Car Corp	$260,260	$219,619
Safety Car Heating & Lighting Co	$361,186	$231,175
Scovill Mfg. Co	$730,576	$305,688
Standard Screw Co	$319,295	$47,674
Standard Steel Spring Co	$110,792	*d*$172,908
Stromberg-Carlson Telephone Mfg. Co	*d*$265,426	*d*$331,128
Symington Co	*d*$242,561	*d*$317,997
Universal Pipe & Radiator Co	*d*$245,084	*d*$594,205
Waco Aircraft Co	*d*$66,966	$67,733
Yellow Truck & Coach Mfg. Co	*d*$886,468	*d*$982,348

*Four months to close of 1934.

d—Deficit.

• PATENTS •

March 19, 1935

Metal-Working Machinery

Automatic Feed Control Mechanism. Raymond A. Carlson, Rockford, Ill., assigned to Rockford Drilling Machine Co. Patent 1,994,463.

Electric Welding Apparatus. Edward A. Hobart, Troy, Ohio, assigned to the Hobart Bros. Co. Patent 1,994,609.

Drill Press. Camillo Landriani, Bronxville, N. Y. Patent 1,994,772.

Die Casting Machine. Albert S. Kux, Chicago, Ill. Patent 1,994,824.

Machine Tool. Olav Tweit, West Orange, N. J. Patent 1,994,879.

Arc Welding Apparatus. John W. Dawson, Wilkinsburg, Pa., assigned to Westinghouse Electric & Manufacturing Co. Patent 1,994,907.

Drill Grinder. Arthur Williams, Fort Wayne, Ind., assigned to Aloysius Lyle Poinsette and Leo J. Poinsette. Patent 1,994,975.

Flash Butt Welding Apparatus. Masaji Ito, Sumaura-Dori, Suma-Ku, Kobe, Japan, assigned to Kabushiki Kaisha Kawasaki Zosensho (Kawasaki Dockyard Co., Ltd.), Higashi Kawasaki Machi, Minatohigashi-Ku, Kobe, Japan. Patent 1,995,001.

Tools and Attachments

Electric Arc Welding Electrode. Robert K. Hopkins, New York, N. Y., assigned to the M. W. Kellogg Co. Patent 1,994,650.

Apparatus for Forming Chain Link Blanks. Frank E. Stahl, Tonawanda, N. Y., assigned to Columbus McKinnon Chain Corp. Patent 1,994,794.

Dial Test Indicator. Albert F. Plitt, Bryan, Ohio. Patent 1,994,833.

Welding Torch Mixer. Roy Thomas, Los Angeles, Calif., assigned to the Bastian-Blessing Co. Patent 1,994,841.

Grinding Tool. Fred Glassford, Royal Oak, Mich., assigned to Chrysler Corp. Patent 1,995,027.

Processes

Method of Making Universal Joint Yokes. Othmar I. Larsen, Winnetka, Ill. Patent 1,994,480.

Method for Welding Wheels. Oscar U. Zerk, Cleveland, Ohio, assigned to Zerk Corp. Patent 1,994,557-1,994,558.

Method of Manufacturing Forged, Pressed, or Rolled Work Pieces, Especially Crank Shafts. Friedrich Wilhelm Nierhaus, Dortmund, Germany, assigned to Vereinigte Stahlwerke Aktiengesellschaft, Dusseldorf, Germany. Patent 1,994,863.

Radiator and Method of Making the Same. Ralph Warfender, Sharon, Pa., assigned to Westinghouse Electric & Manufacturing Co Patent 1,994,903.

March 26, 1935

Metal-Working Machinery

Worm Wheel Generating Machine. Oliver G. Simmons, Lakewood, Ohio, assigned to Dual L. Simmons. Patent 1,995,328.

Drop Hammer. Bertis U. Urschel, Bowling Green, Ohio. Patent 1,995,441.

Machine For Coiling and Packaging Strand Material. Michael J. Dempsey and Frederick W. Reher, Waterbury, Conn., assigned to The Chase Companies. Patent 1,995,498.

Milling Machine. Walter Ferris, John P. Ferris, and Walter Mickelson, Milwaukee, Wis., assigned to The Oilgear Co. Patent 1,995,638.

Apparatus For Manufacturing Armored Conductors. Edwin J. Schneider, Jamaica, N. Y., assigned to Eastern Tube and Tool Co. Patent 1,995,866.

Tools and Attachments

Device For Dressing Grinding Wheels. Harry Hallam, Leicester, England, assigned to United Shoe Machinery Corporation. Patent 1,995,304.

Punching Mechanism. Frank Bishop, Los Angeles, Calif. Patent 1,995,466.

Machine to Countersink Twenty Holes in a Wheel Hub Shell for Short Spokes. Herman Tormyn and Frank F. Wiethoff, Detroit, Mich., assigned to General Motors Corporation. Patent 1,995,485.

Machine to Rivet Bolt Flange in Hub Shell. Herman Tormyn and Frank F. Wiethoff, Detroit, Mich., assigned to General Motors Corporation. Patent 1,995,486.

Machine to Rivet Twenty Short Spokes with Hub and Rim Together. Herman Tormyn and Frank F. Wiethoff, Detroit, Mich., assigned to General Motors Corporation. Patent 1,995,487.

Machine to Rivet Twenty Long Spokes With Hub and Rim Together. Herman Tormyn and Frank F. Wiethoff, Detroit, Mich., assigned to General Motors Corporation. Patent 1,995,488.

Method of Securing Dies, Tools, etc. to Mounting Plates. Benjamin Edward Irmis, Chicago, Ill. Patent 1,995,711.

Apparatus for Making Roller Bearing Cages. Silas A. Strickland, Detroit, Mich. Patent 1,995,759.

Safety Device for Power Presses. Joseph Basil and Louis Rossetti, Detroit, Mich. Patent 1,995,763.

Processes

Method for Generating Worm Wheels. Oliver G. Simmons, Lakewood, Ohio, assigned to Dual L. Simmons. Patent 1,995,327.

Method for Making Sheet Metalware Joints. Aaron Shatkin, Brooklyn, N. Y. Patent 1,995,364.

Method of Fabricating Structural Members. Joseph Sunnen, Kirkwood, Mo. Patent 1,995,368.

• EXPORT • OPPORTUNITIES

Air - conditioning equipment for homes, office buildings, and apartments. *8661, London, England.

Building equipment, box making and marking machinery, mining machinery, and oil burners for ovens. *8664 Johannesburg, South Africa.

Pipe-bending machines. *8665 Jaffa, Palestine.

Screw and rivet manufacturing machinery. *8666 Havana, Cuba.

Bakery machinery and equipment. *8701 Manila, P. I.

Carbon dioxide (dry ice) making machinery. *8692 Brussels, Belgium.

Motors, inboard, heavy duty, Diesel or semi-Diesel. *8693 Palermo, Italy.

Spinning machine for fique fiber, and machine for weaving. †8697 Bogota, Colombia.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington or any district or cooperative office.

S. A. E. Official Steel Specifications

Revised to January 1935

Courtesy of The Union Drawn Steel Company

Explanation of the S. A. E. Numbering System

The numerical index system, commonly referred to as the S.A.E. Standard System, was developed by the Society of Automotive Engineers, Inc., to provide a simple means of indicating the chemical composition of the various steel grades in more common use. The present revision has been brought about by the development and general application of numerous new steel analyses during recent years and the necessity for extending the system to cover them.

The system is based on the use of numbers composed of four or five digits, and certain letters used as prefixes. The first digit of the standard number indicates the type to which the particular steel belongs. Thus "1" indicates a carbon steel, "2" a nickel steel, "3" a nickel chromium steel, "4" a molybdenum steel, etc. In the case of the alloy steels, the second digit, and sometimes the third, usually indicate the approximate percentage of the principal alloy,—in the case of simple alloys, the alloy from which the steel is named. The final two (sometimes three) digits indicate the mean carbon content in "points," or one-hundredths of one percent. Thus, "2320" indicates a nickel steel of approximately 3% nickel content (3.25%/3.75%) and .20% average carbon (.15%/.25%); "52100" indicates a chromium steel of more than 1% average chromium content (1.20%/1.50%, as compared with .60%/.90% or .80%/1.10% for the 5100 series) and 1.00% carbon (.95%/1.10%), while "71360" indicates a tungsten steel of 13% tungsten content (12%/15%) and .60% carbon (.50%/.70%).

The prefix "X" is used in several instances to indicate variations in the range of sulphur, manganese and chromium, and the prefix "T" is used with Manganese Steels to indicate a higher range of manganese than that found in steels of the X1300 series.

Basic numerals of the system are:

CARBON STEELS First digit—1	
Plain Carbon	10 . .
Free Cutting (Screw Stock)	11 . .
Free Cutting (Manganese)	X13 . .
High Manganese	T13 . .
ALLOY STEELS	
Nickel First Digit—2	
.50% Nickel	20 . .
1.50% Nickel	21 . .
3.50% Nickel	23 . .
5.00% Nickel	23 . .
Nickel-Chromium First Digit—3	
1.25% Nickel, .60% Chromium	31 . .
1.75% Nickel, 1.00% Chromium	32 . .
3.50% Nickel, 1.50% Chromium	33 . .
3.00% Nickel, .80% Chromium	34 . .
Corrosion & Heat Resisting (Stainless)	30 . . .
Molybdenum First digit—4	
Chromium-Molybdenum	41 . .
Chromium-Nickel-Molybdenum	43 . .
Nickel-Molybdenum	46 . .
and	48 . .
Chromium First digit—5	
Low Chromium (up to 1.10%)	51 . .
Medium Chromium	52 . . .
Corrosion & Heat Resisting (Stainless)	51 . . .
Chromium-Vanadium (.80%/1.10% Chromium)	61 . .
Tungsten	7 . . .
and	71 . . .
Silico-Manganese	9 . . .

CARBON STEELS

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.
1010	.05-.15	.30- .60	.045	.055
1015	.10-.20	.30- .60	.045	.055
X1015	.10-.20	.70-1.00	.045	.055
1020	.15-.25	.30- .60	.045	.055
X1020	.15-.25	.70-1.00	.045	.055
1025	.20-.30	.30- .60	.045	.055
X1025	.20-.30	.70-1.00	.045	.055
1030	.25-.35	.60- .90	.045	.055
1035	.30-.40	.60- .90	.045	.055
1040	.35-.45	.60- .90	.045	.055
X1040	.35-.45	.40- .70	.045	.055
1045	.40-.50	.60- .90	.045	.055
X1045	.40-.50	.40- .70	.045	.055
1050	.45-.55	.60- .90	.045	.055
X1050	.45-.55	.40- .70	.045	.055
1055	.50-.60	.60- .90	.040	.055
X1055	.50-.60	.90-1.20	.040	.055
1060	.55-.70	.60- .90	.040	.055
1065	.60-.75	.60- .90	.040	.055
X1065	.60-.75	.90-1.20	.040	.055
1070	.65-.80	.60- .90	.040	.055
1075	.70-.85	.60- .90	.040	.055
1080	.75-.90	.60- .90	.040	.055
1085	.80-.95	.60- .90	.040	.055
1090	.85-1.00	.60- .90	.040	.055
1095	.90-1.05	.25- .50	.040	.055

FREE CUTTING STEELS

S. A. E. No.	Carbon Range	Mang. Range	Phos. Range	Sulfur Range
1112	.08-.16	.60- .90	.09-.13	.10 -.20
X1112	.08-.16	.60- .90	.09-.13	.20 -.30
1115	.10-.20	.70-1.00	.045 max.	.075-.15
1120	.15-.25	.60- .90	.045 max.	.075-.15
X1314	.10-.20	1.00-1.30	.045 max.	.075-.15
X1315	.10-.20	1.30-1.60	.045 max.	.075-.15
X1330	.25-.35	1.35-1.65	.045 max.	.075-.15
X1335	.30-.40	1.35-1.65	.045 max.	.075-.15
X1340	.35-.45	1.35-1.65	.045 max.	.075-.15

MANGANESE STEELS[1]

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.
T1330	.25-.35	1.60-1.90	.040	.050
T1335	.30-.40	1.60-1.90	.040	.050
T1340	.35-.45	1.60-1.90	.040	.050
T1345	.40-.50	1.60-1.90	.040	.050
T1350	.45-.55	1.60-1.90	.040	.050

S. A. E. Official Steel Specifications

Revised to January 1935

Courtesy of The Union Drawn Steel Company

NICKEL STEELS[1]

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.	Nickel Range
2015	.10-.20	.30-.60	.040	.050	.40- .60
2115	.10-.20	.30-.60	.040	.050	1.25-1.75
2315	.10-.20	.30-.60	.040	.050	3.25-3.75
2320	.15-.25	.30-.60	.040	.050	3.25-3.75
2330	.25-.35	.50-.80	.040	.050	3.25-3.75
2335	.30-.40	.50-.80	.040	.050	3.25-3.75
2340	.35-.45	.60-.90	.040	.050	3.25-3.75
2345	.40-.50	.60-.90	.040	.050	3.25-3.75
2350	.45-.55	.60-.90	.040	.050	3.25-3.75
2515	.10-.20	.30-.60	.040	.050	4.75-5.25

NICKEL CHROMIUM STEELS[1]

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.	Nickel Range	Chromium Range
3115	.10-.20	.30-.60	.040	.050	1.00-1.50	.45- .75
3120	.15-.25	.30-.60	.040	.050	1.00-1.50	.45- .75
3125	.20-.30	.50-.80	.040	.050	1.00-1.50	.45- .75
3130	.25-.35	.50-.80	.040	.050	1.00-1.50	.45- .75
3135	.30-.40	.50-.80	.040	.050	1.00-1.50	.45- .75
3140	.35-.45	.60-.90	.040	.050	1.00-1.50	.45- .75
X3140	.35-.45	.60-.90	.040	.050	1.00-1.50	.60- .90
3145	.40-.50	.60-.90	.040	.050	1.00-1.50	.45- .75
3150	.45-.55	.60-.90	.040	.050	1.00-1.50	.45- .75
3215	.10-.20	.30-.60	.040	.050	1.50-2.00	.90-1.25
3220	.15-.25	.30-.60	.040	.050	1.50-2.00	.90-1.25
3230	.25-.35	.30-.60	.040	.050	1.50-2.00	.90-1.25
3240	.35-.45	.30-.60	.040	.050	1.50-2.00	.90-1.25
3245	.40-.50	.30-.60	.040	.050	1.50-2.00	.90-1.25
3250	.45-.55	.30-.60	.040	.050	1.50-2.00	.90-1.25
3312	max. 0.17	.30-.60	.040	.050	3.25-3.75	1.25-1.75
3325	.20-.30	.30-.60	.040	.050	3.25-3.75	1.25-1.75
3335	.30-.40	.30-.60	.040	.050	3.25-3.75	1.25-1.75
3340	.35-.45	.30-.60	.040	.050	3.25-3.75	1.25-1.75
3415	.10-.20	.30-.60	.040	.050	2.75-3.25	.60- .95
3435	.30-.40	.30-.60	.040	.050	2.75-3.25	.60- .95
3450	.45-.55	.30-.60	.040	.050	2.75-3.25	.60- .95

MOLYBDENUM STEELS[1]

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.	Chrom. Range	Nickel Range	Moly. Range
4130	.25-.35	.50-.80	.040	.050	.50- .80	.....	.15-.25
X4130	.25-.35	.40-.60	.040	.050	.80-1.10	.....	.15-.25
4135	.30-.40	.60-.90	.040	.050	.80-1.10	.....	.15-.25
4140	.35-.45	.60-.90	.040	.050	.80-1.10	.....	.15-.25
4150	.45-.55	.60-.90	.040	.050	.80-1.10	.....	.15-.25
4340	.35-.45	.50-.80	.040	.050	.50- .80	1.50-2.00	.30-.40
4345	.40-.50	.50-.80	.040	.050	.60- .90	1.50-2.00	.15-.25
4615	.10-.20	.40-.70	.040	.050	.....	1.65-2.00	.20-.30
4620	.15-.25	.40-.70	.040	.050	.....	1.65-2.00	.20-.30
4640	.35-.45	.50-.80	.040	.050	.....	1.65-2.00	.20-.30
4815	.10-.20	.40-.60	.040	.050	.....	3.25-3.75	.20-.30
4820	.15-.25	.40-.60	.040	.050	.....	3.25-3.75	.20-.30

CHROMIUM STEELS[1]

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.	Chromium Range
5120	.15- .25	.30-.60	.040	.050	.60- .90
5140	.35- .45	.60-.90	.040	.050	.80-1.10
5150	.45- .55	.60-.90	.040	.050	.80-1.10
52100	.95-1.10	.20-.50	.030	.035	1.20-1.50

CHROMIUM VANADIUM STEELS[1]

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.	Chrom. Range	Vanadium	
						Min.	Desired
6115	.10- .20	.30-.60	.040	.050	.80-1.10	.15	.18
6120	.15- .25	.30-.60	.040	.050	.80-1.10	.15	.18
6125	.20- .30	.60-.90	.040	.050	.80-1.10	.15	.18
6130	.25- .35	.60-.90	.040	.050	.80-1.10	.15	.18
6135	.30- 40	.60-.90	.040	.050	.80-1.10	.15	.18
6140	.35- .45	.60-.90	.040	.050	.80-1.10	.15	.18
6145	.40- .50	.60-.90	.040	.050	.80-1.10	.15	.18
6150	.45- .55	.60-.90	.040	.050	.80-1.10	.15	.18
6195	.90-1.05	.20-.45	.030	.035	.80-1.10	.15	.18

TUNGSTEN STEELS[1]

S. A. E. No.	Carbon Range	Mang. Max.	Phos. Max.	Sulfur Max.	Chromium Range	Tungsten Range
71360	.50-.70	.30	.035	.040	3.00-4.00	12.00-15.00
71660	.50-.70	.30	.035	.040	3.00-4.00	15.00-18.00
7260	.50-.70	.30	.035	.040	.50-1.00	1.50- 2.00

SILICON MANGANESE STEELS

S. A. E. No.	Carbon Range	Mang. Range	Phos. Max.	Sulfur Max.	Silicon Range
9255	.50-.60	.60-.90	.040	.050	1.80-2.20
9260	.55-.65	.60-.90	.040	.050	1.80-2.20

CORROSION AND HEAT-RESISTING ALLOYS

S. A. E. No.	Carbon Max.	Mang. Max.	Phos. Max.	Sulfur Max.	Silicon Max.	Chromium Range	Nickel Range
30905	.08	.20-.70	.030	.030	.75	17.00-20.00	8.00-10.00
30915	.09-.20	.20-.70	.030	.030	.75	17.00-20.00	8.00-10.00
51210	.12	.60	.030	.030	.50	11.50-13.00	.....
X51410	.12	.60	.030	.15-.50	.50	13.00-15.00	.....
51335	.25-.40	.60	.030	.030	.50	12.00-14.00	.....
51510	.12	.60	.030	.030	.50	14.00-16.00	.....
51710	.12	.60	.030	.030	.50	16.00-18.00	.....

[1]Silicon range of all S.A.E. basic open hearth alloy steels shall be 0.15-0.30. For electric and acid open hearth alloy steels, the silicon content shall be 0.15 min.

T-C Tools in the Railroad Shop

FRANK C. HUDSON

Although railroad shops are handicapped by small quantity production and, in too many cases by machine tools that have seen better days, some of them are alive to the possibilities of tungsten-carbide tools. One rather striking example of this is shown in the following table from a shop that, while not one of the best known, is part of a progressive system, and evidently has a very live management.

Records have been kept on the results obtained by both high-speed and tungsten-carbide tools, on the same jobs. In some of these cases at least, the machines were run at their maximum speeds, which was evidently below the possibility of the tungsten-carbide tools. Then, too, the small number of pieces made at one set-up, prevents the best results being obtained. The average number of pieces machined at each set-up is given as: Floating bushing, main driving box, 2; crown brasses, 6; floating bushing, trailing truck, 2, while cylinder bushings are usually made one at a time.

As the work done is the same with both high-speed steel and tungsten-carbide tools, the real comparisons are between cutting speeds and elapsed time. While the differences are not entirely uniform, the results show 216 ft. per min. as against 180 for the floating bushing of the main driving box. This is one case where the top speed of the boring mill was used to get 216 ft. It is probable that 240 ft. or 250 ft. might have been used had it been available.

In the crown brasses we have 232 ft. as against 110; in the trailer-truck bushing 236 against 160, and in the cylinder bushing, 99 against 40. This is the only cast-iron part, and gives nearly a 150 per cent increase, while the greatest increase for brass and bronze is 120 per cent. It is also interesting to note the tool life mentioned in the first item.

Comparisons of elapsed time for each piece shows the part played by handling, and its increasing importance as the cutting time is decreased. In the second item, for example, the cutting speed was increased from 110 to 232 ft. per min, yet the reduction in time was much less in proportion, from 50 min. to 30 min. Had the same rate been possible for the whole operation, the elapsed time would have been under 24 minutes. For strict comparisons in cutting time, the handling should be timed separately. This factor shows the advantages of quick operating fixtures as the cutting speed is increased.

Other interesting studies can be made from these comparisons. And they should stimulate others to see what can be done in their own shops.

Some Hints From an Old Timer

CHARLES WESLOW

Every die or tool that is made should have the brand of steel it is made of stamped onto it somewhere, so that in case of alterations to the tool or die the workman will know how to anneal or reharden again. I worked for a metal stamping concern in my home town (Newark, N. J.) in the year 1897 where the amount of time or hours consumed in the making of the dies, was stamped onto them, so that future workmen would have a general idea how many hours they could expect to consume in making another die somewhat similar.

I abhor the mechanic, and even the foreman, who uses the middle of a file to try how hard the die is, or even any other hardened part of any tool. Always, if I must use a file, I use the back end for such a purpose.

Locomotive Parts Machined With Tungsten-Carbide Tools

Machined With Tungsten-Carbide Tools	Rough O.D.	Rough I.D.	Length	Cut speed, F.P.M.	Rough cut O.D.	Rough Cut I.D.	Cut Speed, F.P.M.	Finish cut O.D.	Finish Cut I.D.	Feed R. Cut O.D.	Feed R. Cut I.D.	Feed F. Cut O.D.	Feed F. Cut I.D.	Material	Type of Machine	General Remarks
Floating Bush Main Driving Box	14⅜	11⅝	14	216	¼	⅝	216	1/32	1/32	.018	.018	.018	.018	Bronze	54" Boring Mill	Burnished outside and inside after turning. Time per bush, 2 hr. Note: cutting speed was fastest speed on machine. Same tool in use since Sept., 1930.
Crown Brass Main Driving Box	12⅜	....	13¼	232	1/32	..	...	..	..	.033	....	....	....	Brass	24" Boring Mill	Time per brass 30 min.
Floating Bush Trailing Truck	11¾	8¼	14¼	236	1/32	⅜	236	1/32	1/32	.018	.018	.018	.018	Bronze	24" Boring Mill	This bush has a collar on one end, necessitating bush being turned over to finish, also burnished outside and inside. Time per bush, 2 hr., 10 min.
Locomotive Cylinder Bush	29¼	26¼	42	99	1/32	⅜	99	1/32	1/32	.018	.018	.033	.033	Nickel Cast Iron	54" Cyl. Bush Mill	Bush machined all over, counterbored at ends, and cut to length. Time per bush, 13 hr.
Machined With High-Speed Tools																
Floating Bush Main Driving Box	14⅜	11⅝	14	180	¼	⅜	180	1/32	1/32	.027	.027	.027	.027	Bronze	54" Boring Mill	Burnished outside and inside after turning. Time per bush 3 hr., 30 min.
Crown Brass Main Driving Box	12⅜	....	13¼	110	1/32	..	...	..	..	.033	....	....	....	Brass	24" Boring Mill	Time per brass, 50 min.
Floating Bush Trailing Truck	11¾	8¼	14¼	160	1/32	⅜	160	1/32	1/32	.027	.027	.027	.027	Bronze	24" Boring Mill	This bush has a collar on one end, necessitating bush being turned over to finish. Also burnished outside and inside. Time per bush 3 hr. 45 min.

IDEAS

FROM • PRACTICAL • MEN

Adjustable Pressure Device for Jigs and Fixtures

JOHN A. HONEGGER

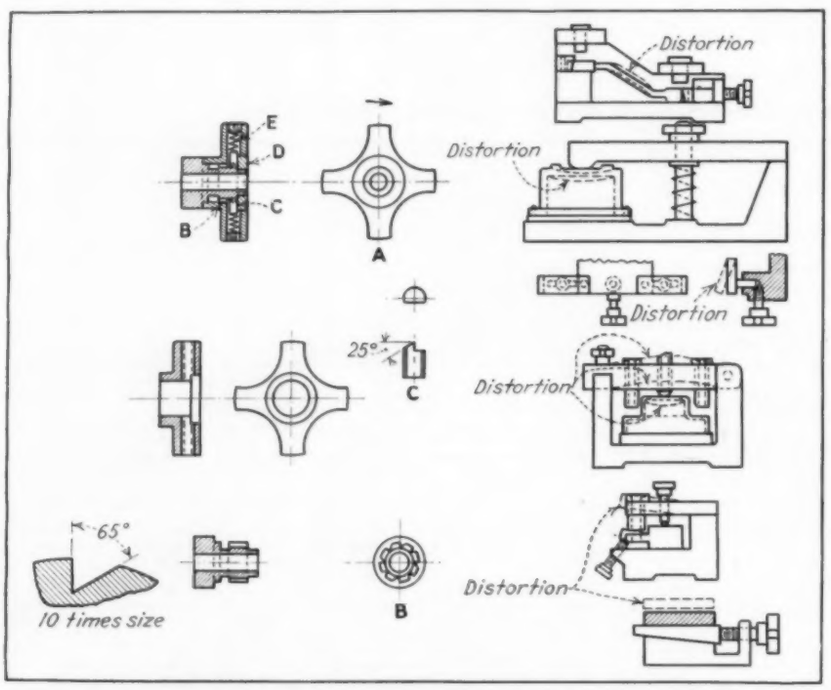
An improvement in the clamping mechanism of jigs and fixtures is an adjustable pressure device that will permit work to be clamped at a predetermined maximum pressure, after which any additional force will be dissipated without injury to either the work or the tool. Such a device should give visual indication when the maximum pressure has been applied, thus eliminating the necessity of relying upon the operator's judgment as to the proper amount of pressure to be applied. Also, it should operate positively in unclamping the work. Such a device would reduce the number of parts spoiled by distortion in either the work or the tool, or both, due to excess clamping pressure.

The adjustable pressure device illustrated was developed to meet these requirements. The hand knob *A* contains a ratchet *B* mounted on a sleeve attached to the screw or other clamping mechanism, the ratchet being operated by pawls in the wings of the knob. Each pawl *C*, has a flat on one side and is retained in axial position by the washer *D* bearing against the flat. The pawls are backed by springs *E* and adjusting screws. When the hand knob is rotated clockwise, the turning moment transmitted to the screw or other clamping mechanism is equal only to the resistance of the pawls on ratchet.

Adjustment of the adjusting screws and a change in the strength of the springs permit a wide variation in pressure of the pawls on the ratchet, thus the pressure applied to the clamping mechanism can be varied from a fraction of an ounce to several pounds. After the device has been set for the desired maximum pressure, the adjusting screws are sealed with wax to prevent tampering. Any force applied to the knob beyond that to which the device has been set will cause the pawls to slip over the ratchet and the knob will rotate freely on the clamping mechanism, thus giving visual indication that the maximum pressure has been applied.

When the hand knob is rotated counter-clockwise, the pawls positively engage the ratchet, rotating it and the clamping mechanism and unclamping the work.

A few constructional designs of fixtures to which this device is applicable are shown at the right in the illustration. The dash-dot lines indicate points of distortion in either the work or the tools due to excessive clamping pressure.

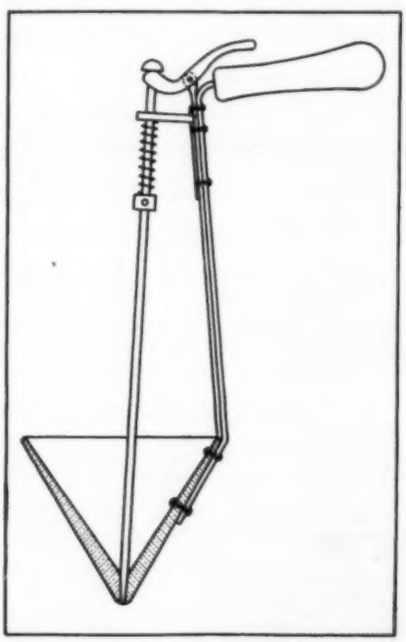


This device can be so adjusted that the pressure transmitted by it to the clamping mechanism will not exceed the predetermined amount for which it has been set

Bottom-Pouring Hand Ladle

JAMES H. RODGERS
Toronto, Ontario, Canada

A ladle in which the metal is poured from the bottom is shown in the illustration. By its construction the weight comes in almost a vertical direction below the handle, so that the wrist is relieved from excessive strain. The stream of molten metal, coming from the bottom at the apex of the



This ladle is very convenient for filling blow holes in castings with soft metal. The valve will not clog so long as the metal is well above the melting point

cone, can easily and accurately be guided into a very small opening.

The ladle is made of brass and the shank of the handle is riveted to the side. While the needle valve is normally kept closed by a spring, it is opened by pressure of the thumb on the trigger. In filling the ladle it is lowered in an upright position in the melting pot with the valve open. The molten metal thus enters at the bottom and is free from dross. So long as the metal in the ladle is well above the melting point there is no danger of the valve becoming clogged.

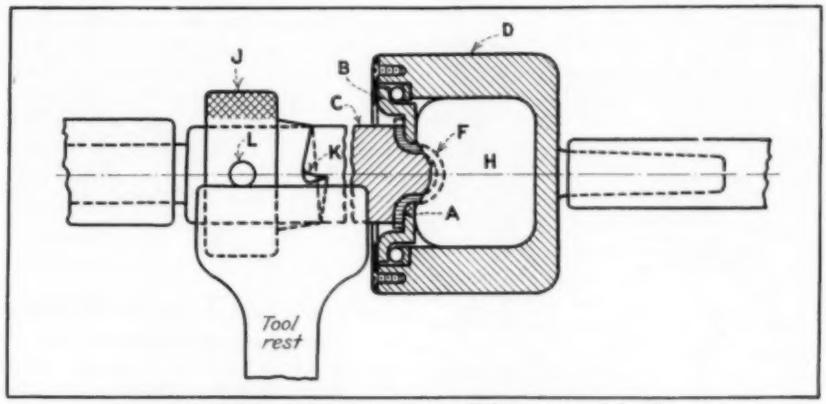
While this particular ladle is used in the composing room of a printing plant for filling odd-shaped holes in type forms, it will be found very useful in filling blow holes in castings.

Lathe Fixture for Trimming Leather Packing Cups

HARRY S. TAYLOR

The blanks for leather packing cups are first cut in a press and are then treated in a solution to make them pliable to prevent them from cracking when they are cupped. After the cups are thoroughly dry the closed ends are cut off and the outsides are trimmed by the device illustrated which is used in a bench lathe.

The packing cup *A* is held between the plate *B* and the formed plug *C* held in the spindle, plate *B* being mounted on a ball bearing. The fixture *D* is held by a shank in the tailstock spindle, which is pressed forward by a spring (not shown) to grip the cup. The closed end *F* of the cup is cut off by a curved hand-knife entered through the opening *H*. The outside of the cup is trimmed by the sliding tool *J*, which has a cutting edge at *K* and is prevented from revolving by the pin *L* contacting the tool rest. The outside of the tool is knurled for a finger grip. As soon as the tailstock spindle is backed away, the cup jumps out of the fixture, due to the spring of the leather.



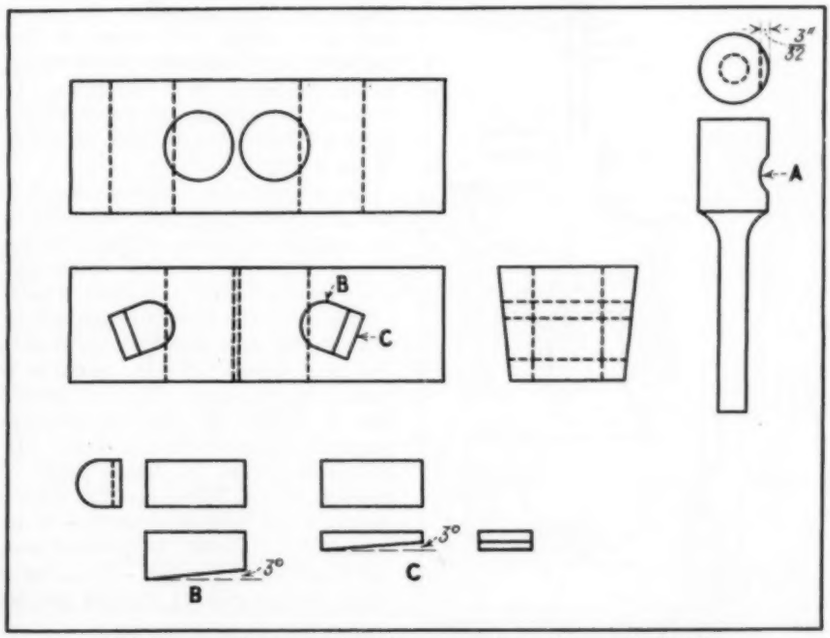
The closed end of the cup is cut off by a curved knife entered through an opening in the fixture and the outside is trimmed by a sliding tool

Holding Punches by Wedges

BERT WALLACE

In punching semi-hard steel $\frac{3}{8}$ in. thick we had trouble in holding the punches in the punch holder. We bought a patent punch holder but still had trouble.

Finally we grooved the punch shanks, as at *A*, and held them in place by the hardened wedges *B* and *C*. The reason for using the two wedges was because we could machine the holes for them in the punch holder with the sides straight easier than we could make them taper to suit a single wedge. The grooves in the punch shanks varied only in the amount caused by distortion in hardening, so that very little variation had to be provided for.

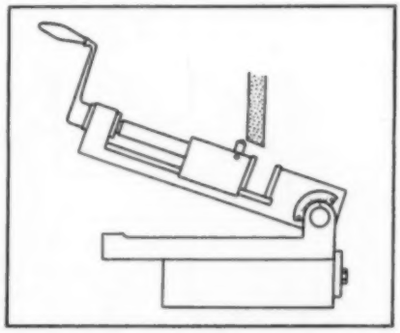


With one wedge engaging the groove in each punch shank and the other used for tightening, the punches were securely held in the punch holder

Dressing Abrasive Wheels at an Angle

W. S. KLAY

In dressing abrasive wheels of surface grinders at an angle, the simple method illustrated involves the use of an ad-



The angle is determined by the graduations on the adjustable vise and the diamond is passed back and forth across the face of the wheel by operating the vise crank

justable machine vise having graduations at its pivot. A hole is drilled in the top of the movable jaw for the diamond, and a hole is drilled and tapped endwise of the jaw to hold the diamond in place

The vise is mounted on a magnetic chuck on the table of the grinder, being set against a stop. It is adjusted to the desired angle and the diamond is passed back and forth across the face of the wheel by operating the movable jaw by the vise crank.

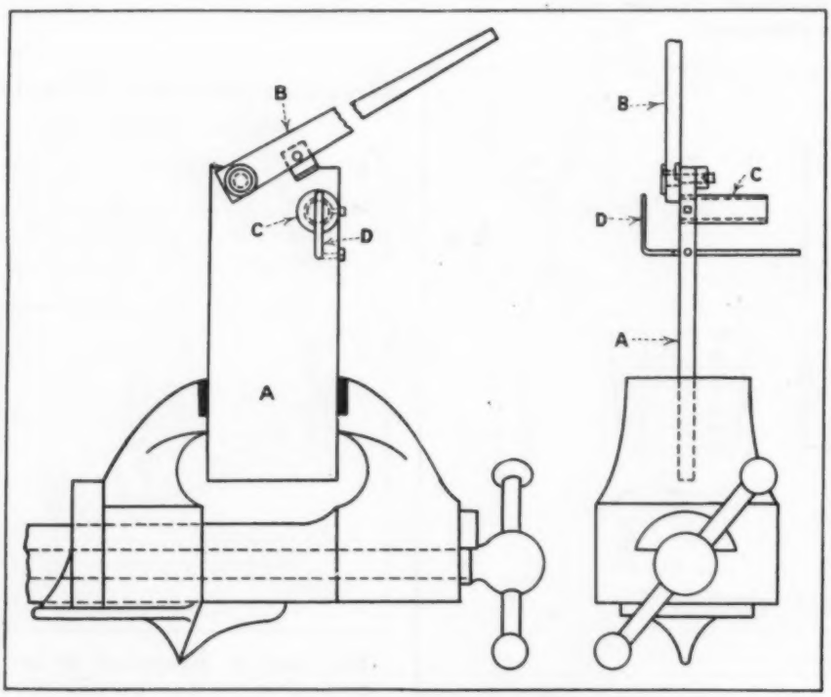
Shear for Cutting Off Helical Springs

J. J. THOMPSON

The portable shear illustrated has been in use in our shop for a long time for cutting off helical springs of various diameters and lengths.

The body *A* is a ¾x4x12-in. steel plate, to which the lever *B* carrying the movable shear blade is pivoted. A hardened and ground bushing *C* is pressed into the plate and serves the double purpose of a tube through which to feed the springs, and a stationary shear blade.

As the bushing is about 4½ in. long, it is almost impossible for the operator to put his finger in danger of being cut when pushing the last end of the spring through it. The adjustable stop *D* is provided for controlling the length of the springs. The shear can either be held in a bench vise or attached to the end of the bench by lagscrews.



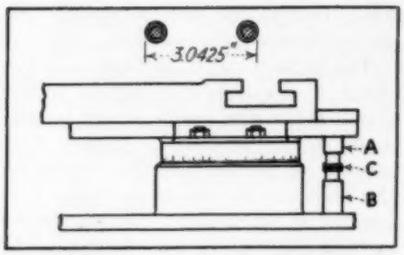
Helical springs can be quickly cut to length by this portable shear. The springs are fed through a bushing, which also acts as a stationary shear blade, to an adjustable stop

Setting the Compound Rest to Accurate Angles

WILTON F. HOAG

When the compound rest must be set more accurately to an angle than the graduations on the base will permit, it can be accomplished by measuring over plugs set in the base and in the toolblock, as shown in the illustration.

The plugs *A* and *B* are hardened, ground and lapped and are pressed into holes drilled and reamed in line when the rest is at a right angle to the spindle. The compound rest can be set to angles on either side of zero, as the plug in the base will pass over the one in the toolblock, as shown at *C*. This clearance should not be more than 0.01 in. The plugs are necked as shown to reduce the width of the surfaces on which the micrometer must contact. These surfaces are 0.01 in. wide and do not cause any difficulty



By measuring over the outside of plugs located as shown, the compound rest can be set accurately to any desired angle on either side of mean position

in obtaining the correct measurement across their diameters.

If, for example, it is required to set the compound rest to an angle of 29 deg. 27 min. 30 sec. and the plugs are 0.5 in. in diameter and their centers are 5 in. from the center of rotation of the compound rest, the measurement over the plugs will be the chord of the angle multiplied by five, plus the diameter of one plug, thus: Chord 29 deg. 27 min. 30 sec. $\times$ 5 + 0.5 = 3.0425 in.

Calculating Tap-Drill Sizes Discussion

WILLIAM S. ROWELL

The rule for calculating tap-drill sizes given by J. Ed. Gilbraith in an article under the title given above (*AM*—Vol. 78, page 797) is simple and gives results very close to National (U.S.S.) standards. But it should be remembered that according to National standards for commercially threaded holes, the threads are from ¾ to ⅝ full depth.

The rule given in *American Machinists' Handbook*, page 132, fifth edition, for approximate sizes of tap-drills for coarse threads is far more simple and gives approximately the same results.

It has always been my practice to compute tap-drill sizes from the double depth of threads of 1-in. pitch as a base. In National (U.S.S.) threads this is 1.29903 in. For all practical purposes 1.3 in. is close enough. My rule is to divide the double depth of threads of 1-in. pitch by the double depth of the threads of the tap to be used and to subtract the quotient from the diameter of the tap. Thus, for a ½-in. tap having 13 threads per in. the figures would be $\frac{13}{1.3} = 0.100$ in.

and the tap drill for ½-in. U.S.S. full thread would be 0.500 — 0.100 = 0.400 in. If nearly a full thread is wanted, a $\frac{13}{32}$-in. drill is close enough.

The rule is so simple that no difference how exceptional the conditions or how mismated the diameter and the pitch may be, it can be applied in less time than it takes to recite it. All one needs to remember is the double depth of threads of 1-in. pitch. The method gives tap-drill sizes for a full thread, but it can be varied as much as the conditions require.

Holding Work of Irregular Thickness at a Constant Height

H. MOORE
Hamilton, Ontario, Canada

One of the parts of a new type flushing valve was found not accurate enough in practice and the trouble was located in a blind hole that had to be counterbored at an exact depth from the face, although the overall thickness of the part might and did vary as much as $\frac{1}{32}$ in. The counterbore used had no stop collar and, due to the irregular thickness of the work, we could not ordinarily use the machine stop.

The accompanying illustration shows how the problem was solved so that the machine stop could be used. The work was held in a machine vise attached in a vertical position to the inner surface of an angle plate. The vise was set low enough so that the handle could not come off, yet having ample swing for tightening and loosening the work. It will be seen that the work is tightened against the fixed jaw of the vise, so that the face to be counterbored is always at the same height, no matter how much the thickness may vary.

Tool for Cutting Sheet Metal—Discussion

A. EYLES
St. Albans, Hertfordshire, England

The tool described by M. G. Demougeot in an article under the title given above (*AM*—Vol. 79, page 58) reminded me of similar tools that I made about 20 years ago from discarded 8-in. flat files. The ends of the files were forged to semicircular shape and were drawn to $\frac{1}{16}$ in. in thickness and $\frac{3}{8}$ in. in width. After hardening and tempering, the cutting edges were ground very sharp. The tangs were driven into file handles.

For cutting straight edged pieces of aluminum, brass, copper, duralumin and zinc up to $\frac{1}{16}$ in. in thickness from long sheets, this type of tool is useful in shops not having a machine for cutting thin metals.

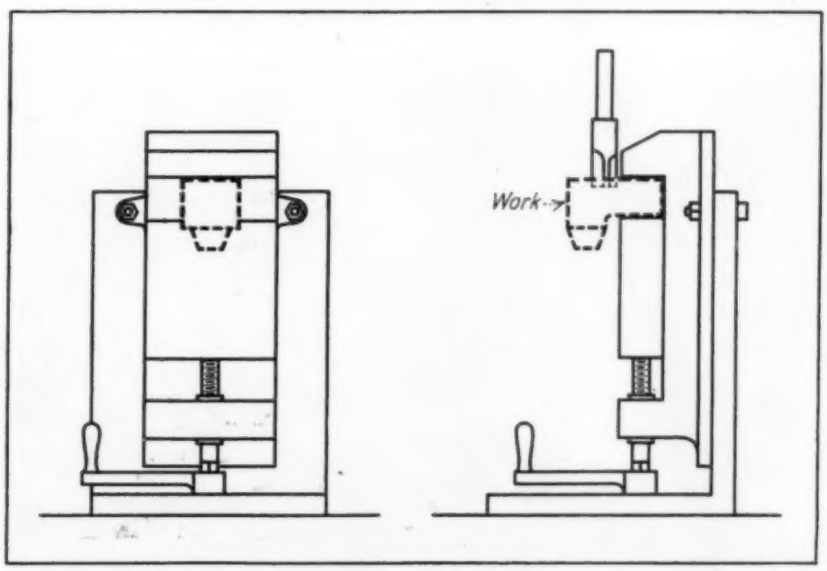
Experience in cutting sheet metal with this type of tool has proved that it is not necessary to cut completely through the metal. In cutting sheet zinc it is necessary only to draw the tool along the layout line judiciously once or twice and then bend the metal sharply on the layout line in order to sever it. Zinc becomes rather brittle at low temperatures and fractures readily on any scribed line. When cutting thin sheets of aluminum, brass or copper with the grain of the metal, it is not necessary to cut entirely through the metal with the tool in order to obtain the required pieces, as they can be broken along scribed lines.

Press Tools for Drawing Flanged Cups

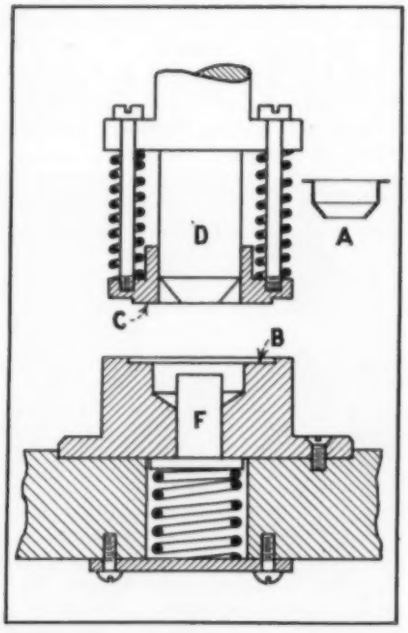
CHARLES H. WILLEY

We recently required several thousand small flanged cups, as at *A*, to be used as reflector bases in connection with a meter product. Since the cups had to be made cheaply, we naturally wanted to keep the cost of the tools as low as possible. The tools illustrated were designed for the job and are quite simple. The cups were drawn from brass disks 1¼ in. in diameter and 0.020 in. thick, of which we had plenty left as cutouts from another product.

The blanks were placed in the nest *B* and when the ram descended they were held by the spring-actuated pressure ring *C*, the drawing being done by the punch *D*. On the ascent of the ram, the spring-actuated knockout *F* pushed the cups out of the die. The cups were drawn ½ in. deep and the flanges were trimmed separately.



By this method of holding the work the depth of the counterbore from the face was correct, irrespective of the thickness of the work



The flanged cups were drawn in these simple tools from scrap cutouts left from another product, making the cost low

SHOP EQUIPMENT NEWS

"Power-Flex" Model 5-D Two-Spindle Automatic Chucking and Turning Machine

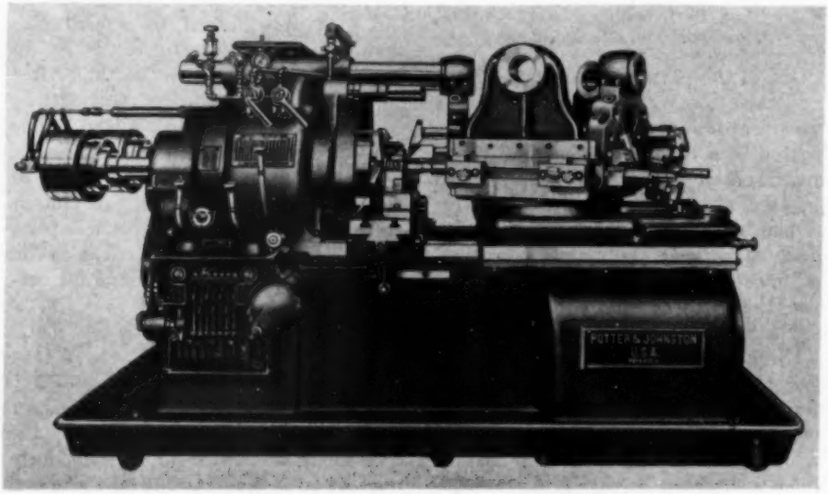
The Potter & Johnson Machine Co., Pawtucket, R. I., is now building a two-spindle, Model 5-D "Power-Flex" automatic chucking and turning machine to the following specifications: Distance between centers of spindles, 15½ in.; swing over cross-slide, 13⅛ in.; travel of cross-slide, straddle cut—each way, 2¼ in.; with 10 in. diameter work, straight single tool facing—each way, 4½ in.; number of turret faces, 5; diameter of turret holes, 2½ in.; depth of turret holes, 3½ in.; distance from center of turret hole to top of turret slide, 5½ in.; total turret slide travel; 11⅝ in.; turret feed, 11 in.; turret slide adjustment, 5½ in.; cross-slide adjustment, 9⅞ in.; diameter of hole through the spindle, 1⅛ in.; power required to drive, 10 to 15 hp., and net weight, 14,000 lb.

The base has hardened and ground steel ways. Spindles are mounted in oversize anti-friction bearings, and all headstock gearing is of chrome nickel steel, spiral tooth form. There are 28 changes of speed between 19 and 613 r.p.m. Speeds are arranged in seven sets of four automatic changes. Any group of four automatic changes may be obtained by application of the proper set of hand pick-off gears located in a compartment at the end of the headstock. A number of intermediate combinations may be secured by means of special pick-off gears.

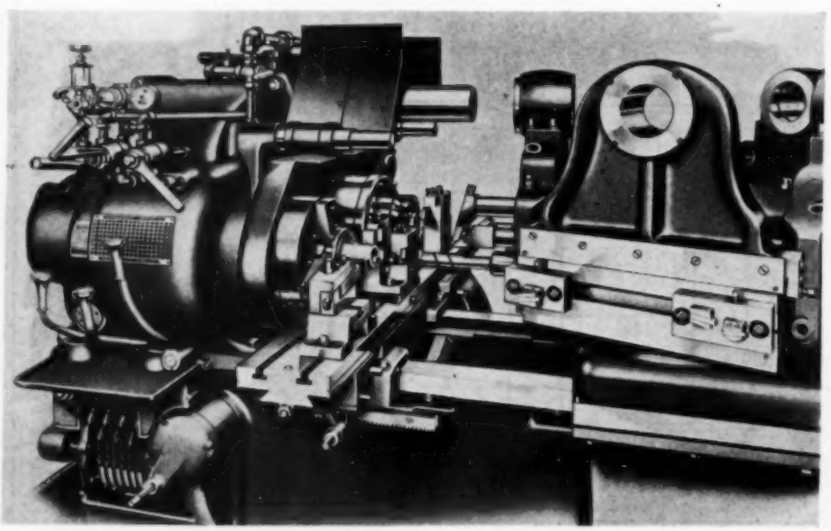
The automatic spindle stop allows the cutting tools to return to their neutral position without scoring the work. There are 24 feeds arranged in geometric progression. They can be furnished in either a coarse feed box with a range of 0.0057 to 0.125 in. per spindle revolution, or a fine feed box with a range from 0.0057 to 0.062 in. per rev. There are three automatic changes of feed; namely, coarse, medium, and fine.

The cross-slide cam drum is located directly beneath the cross-slide and the ball-bearing, cam-roll studs are mounted in the cross-slide, thus furnishing a direct connection. Drive to the cam drum is through worm gearing, and the entire cross-slide mechanism is fully inclosed and operates in oil.

The turret slide is provided with hardened and ground steel inserts to form its bearing on the steel base ways. All changes of speed and feed may be accomplished readily while the machine is under cutting load. As the clutches are engaged and disengaged by power, the dogs are under no strain. Air or electrically operated chucks can be supplied. All chucks are provided with means for locating pilot bushings.



In the "Power-Flex" Model 5-D Two-Spindle Automatic Chucking and Turning Machine all changes of speed and feed may be accomplished while under cutting load



Close-up showing the possibilities of the two-spindle construction and the tooling. Direct connection between the cross-slide and its cam drum below is obtained by improved design

Foote-Burt Single-Slide Vertical Hydraulic Surface Broaching Machine

Designed for quick changes from the manufacture of one part to another, a line of single-slide hydraulic broaching machines is offered by the Foote-Burt Co., Cleveland, Ohio. Only the fixture and broach holder need be changed. For plain flat surfaces the broach can be designed to handle several different parts. Cutting stroke of the broach is adjustable for length by means of a stop dog on the slide. High production can be obtained on small parts with limited surface area by stacking two or three pieces in a fixture and using one broach, or by placing the pieces side by side and using two or three broaches side by side in the broach holder. For example, using a down cutting stroke of 8 seconds and an up stroke of 4 seconds, the total time per piece would be 12 seconds, and the production would be 300 pieces per hour. By using the up stroke to load two pieces a production of 600 pieces per hour can be obtained.

The broach slide moves on long square ways, and the hydraulic plunger is fastened to the lower end. When necessary to sharpen it, the broach is removed by withdrawing a few socket-head cap screws, and is quickly reassembled in the locating groove on the broach holder. This holder is bolted to the slide and forms part of the special tooling, all adjustments on the broach being made in the holder.

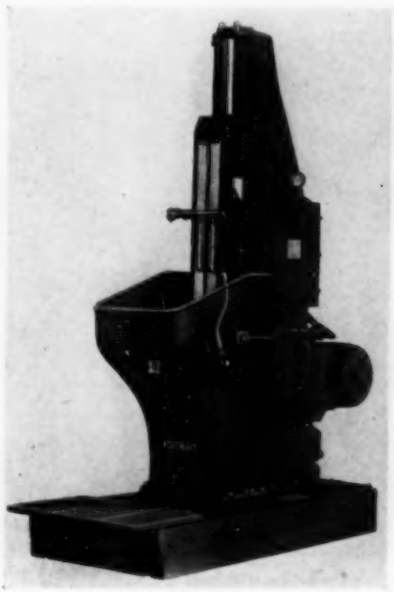
The column or upright is bolted to the work table support and both are bolted to the machine base. The column houses the cylinder, hydraulic pumps, valves and all piping. Hydraulic parts are accessible through openings in the right side of the machine. Work-holding fixtures are mounted on a sliding table which moves to and from the broach on hardened steel ways. These fixtures are designed for each job. Loading is done on the up stroke on the broach. An indexing work table of the rotary type can be supplied. This table is hand-operated and requires an extra work fixture. It provides additional loading time so that work can be loaded both on the up and down strokes.

The machine is built in two sizes, the No. 22 having a capacity of 5 tons and driven by a 10-hp. motor, and the No. 23 with a capacity of 10 tons and driven by a 20-hp. motor.

"Norbide" Pressure Blast Nozzles

Pressure blast nozzles fitted with liners of boron carbide are now available from the Norton Co., Worcester, Mass. These nozzles are guaranteed for 1,500 hours of operation when used with steel abrasive or 750 hours with silica sand. Outside bayonet-type hose fittings are recommended because they are light and easy to apply; they are not subject to wear; they protect the nozzle from abuse; they permit the nozzle to be removed for inspection of the gasket and in case of clogging. The company also has data on adapters and special types of pressure blast nozzles.

These "Norbide" pressure blast nozzles maintain a stream contour and abrasive velocity that improves blasting efficiency. The liners furnished with these nozzles are made from "Norbide" boron carbide which is the hardest manufactured abrasive known. In molded form the material resists abrasion to a greater degree than other substances except the diamond. It is produced in an electric furnace from a compound of boron and carbon and is crystalline in formation. The hardness is considerably greater than that of silicon carbide and is close to that of the diamond. The material is self-binding and can be molded without bond or cementing materials into a homogeneous, one-phase crystalline body of accurate dimensions. When polished it has a hard, smooth, flawless surface. In spite of its hardness, Norbide is lighter than aluminum, its density being 2.52 grams per cu.cm. Norbide boron carbide is marketed in powdered form and in the molded form. In the powdered form it is used for many grinding and lapping jobs which were possible previously only with diamond dust. When molded, as in the liners for the pressure blast nozzles, the material affords extreme resistance to abrasion. It is of a dense, homogeneous structure and is lighter than aluminum.



A variety of "Norbide" nozzles, and at the right a group of boron carbide liners

Hall Double-Head Planetary Milling Machine

So that both ends of a part can be machined simultaneously by the "Planamilling" or "Planathreading" method, a double-head planetary milling machine has been built by the Hall Planetary Co., Philadelphia, Pa. The two head assemblies are fixed to the bed, but both eccentric bearing assemblies can move toward the center to bring them into the working position. Thus, minimum cutter overhang is assured. Actuation of the two eccentric bearing assemblies is effected by means of a hand lever that operates bell cranks by means of a toggle. Movement of the spindles is positive because of the toggle action. The position of each spindle can be separately adjusted.

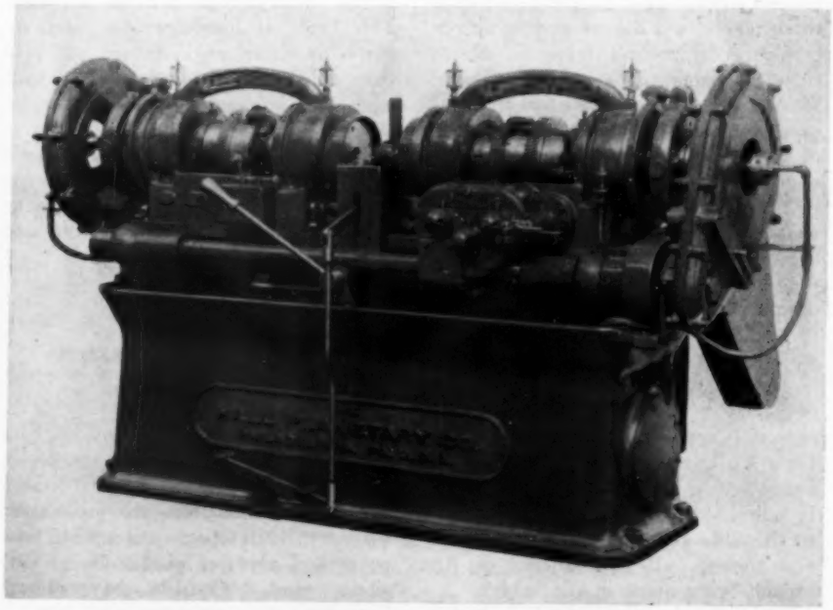
The machine is shown set-up to mill two angular grooves in the opposite ends of the kingpin hole of an automobile front axle. After the work is placed in position the operator pushes a lever which advances the cutter spindles and starts them through the automatic cycle. Floor to floor time for this job is 30 sec. The axle is then turned end for end, and the operation repeated. Other parts which can be handled on this machine for double-end threading or milling operations are rear-axle housing bores, exhaust manifolds, radius rods, universal joints, airplane propellor hubs, and anti-friction bearings.

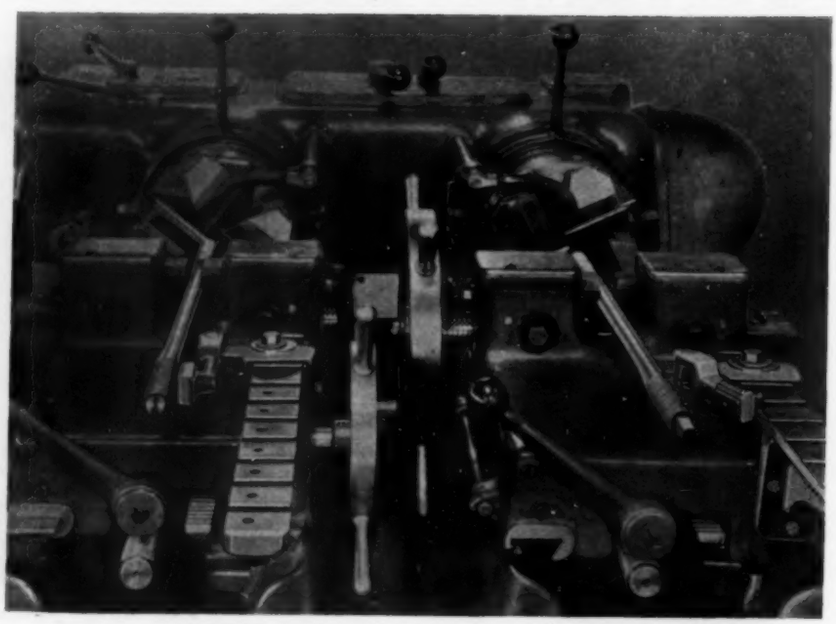
Timing Attachment for "Landmaco" Threading Machine

The Landis Machine Company, Inc., Waynesboro, Pa., has placed on the market an attachment for use on the "Landmaco" threading machines for threading reduced-body staybolts with a continuous-pitch thread on both ends. The timing attachment consists of a bracket attached to the carriage end cover. This bracket is provided with positions for holding the gage bracket as may be required for various lengths of staybolts. The arm attached to the gage bracket carries the gage for timing the thread. All plain radial staybolts are threaded with a 12-pitch thread and the gage is made to fit. The gage arm being pivoted in the bracket permits it to be moved readily for clearing or engaging the thread. The attachment illustrated on the right-hand side of the machine shows the gage swung back to permit removal or insertion of the staybolt in the vise, while the one on the left shows the gage about to be engaged in the thread.

Since a 6-pitch leadscrew is used on the "Landmaco" threading machine and the staybolts are always threaded with a 12-pitch thread, the leadscrew nut on succeeding threads can be engaged at any point on the screw and provide a proper lead. After the original set-up has been made a thread of continuous lead on both ends of the staybolt is assured.

The timing attachment gage is made in the form of an insert held in the gage arm. This permits making lateral adjustment if desired. It also permits the use of various gages of different thread forms, such as U. S., V, or Whitworth, and of different pitches. Uusually only one timing attachment is required on a double-head machine, as its use is not required for threading the first end.



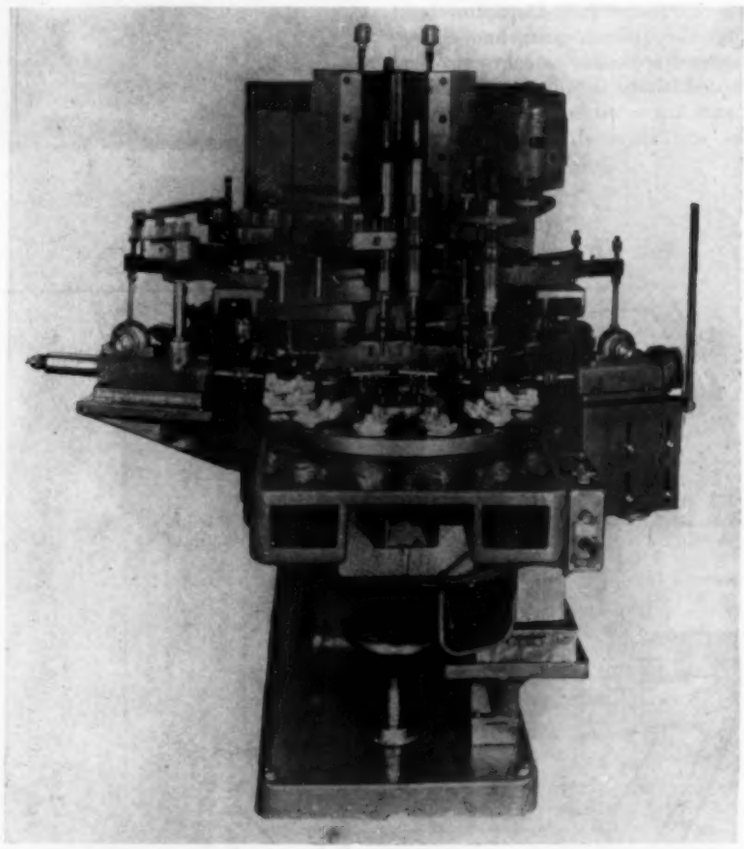


The gage at the left is engaging the staybolt

Bodine No. 48 Dial-Type Drilling and Tapping Machine

A heavier No. 48 dial-type drilling and tapping machine has been developed by the Bodine Corp., 1720 Fairfield Ave., Brideport, Conn., successors to The Anderson Die Machine Company. This machine has a capacity of four ½-in. drills and two ½-in. taps in mild steel. The taps are advanced and reversed by an oscillating segmental gear. Maximum stroke of the slide is 4 in. Spindle speeds can be varied to suit the work. The standard machine provides a maximum of 19 revolutions for the tapping spindles. Special gears can be provided to increase this number when necessary.

The machine is built as a dial-tapping machine, as a dial drilling machine, or as a combination dial drilling and tapping machine. Two sizes of knee are standard—20 and 30 in. The knee is provided with finished pads for the attachment of horizontal spindles, either drilling or tapping, or hopper feeding mechanisms. The drive is from a motor mounted on an adjustable bracket at the rear. Speeds from 10 to 35 strokes per min. are possible, depending on the work. The spindles are equipped with ball and roller bearings and will operate at speeds to 6,000 r.p.m. Each tap spindle carries its own compensator, thus allowing different pitch threads to be tapped simultaneously. The drill spindles have a vertical adjustment for depth of hole. Each spindle is adjustable for position. Hence, by changing dials to accommodate the various pieces to be processed, the machine is flexible in its application.



Guards have been removed from the Bodine No. 48 Dial-Type Drilling and Tapping Machine which is shown equipped with two horizontal and two vertical drilling spindles, and two horizontal and two vertical tapping spindles

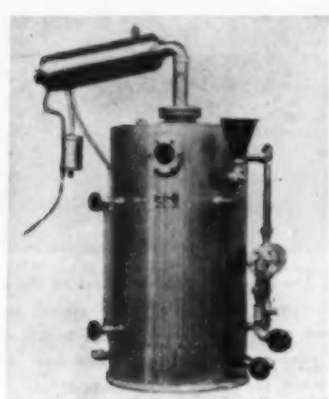
P&H-Hanson 50-Amp. Vertical Welder

The Harnischfeger Corporation, Milwaukee, Wis., has announced a P&H-Hanson 50-amp. vertical welder known as the W50-254. The stable high-speed arc enables the welder to weld down to 26 gage steels. No external

reactors, resistors, or separate stabilizers are required. The self-stabilized arc is achieved through the use of an internal stabilizer winding. Being a motor-generator unit with a 3-hp. squirrel-cage motor, the welder operates on any a.c. power line, including 110 volts, single phase. The current control is a single-adjustment dial at the top of the housing. The welder requires less than 2 ft. of floor space, is 15 in. wide and 36 in. high. It is supplied with a base for stationary mounting, with wheels, or lifting bail.

Barnstead Solvent Recovery Still

The Barnstead Still & Sterilizer Co., Forest Hills, Boston, Mass., has developed a solvent recovery still which permits the users of small amounts of cleaning solvents to recover them in their original purity. The still is adaptable to the recovering of degreasing solvents. It is available for either continuous or batch operation in a full range of capacities. It may be heated by steam, gas or electricity.



"S-B" Plain and Motorized Speed Reducers

Speed reducers in plain and motorized types and in horizontal and vertical models are being introduced, and are manufactured by the Sier-Bath Gear Co., 640 W. 58th St., New York, N. Y. These speed reducers are claimed to give efficiencies as high as 95 per cent according to size, by laboratory tests, and will withstand overloads for reasonable periods without any perceptible drop in efficiency. As a consequence, it is said that the temperature rise with continued operation is negligible. Three distinct series of speed reductions are offered: ratios up to 20 to 1 by means of planetary gearing; standard ratios between 20 to 1 and 120 to 1 by the use of the gyrating principle; and a special group with ratios between 120 to 1 and 180 to 1, also by means of the gyrating principle. Of course, larger reductions can be effected by coupling reducers in tandem. Sizes from ¼ to 50 hp. are available.

Reference to Figs. 1 and 2 shows the application of the gyrating principle. Fig. 2 illustrates a longitudinal section through a motorized speed reducer. Drive shaft *A* has gear teeth cut integrally to drive three spur gears *B*. As shown at *C* these gears have eccentric stub shafts carried in two large ball bearings. The number of teeth in these gears determines the reduction because the other gear elements in a group are fixed. Gears *B* are carried in a rotating cage which is part of the slow-speed shaft *F*. A "gyrating" gear *D* that meshes with the internal gear *E* is actuated by the eccentrics *C*. Under the influence of the eccentrics, the gear *D* moves in an orbit around the center line of the reducer and advances around gear *E*, the total advance per revolution of eccentrics *C* being equal to the difference in the number of teeth in *D* and *E*. Approximately 14 teeth of gears *D* and *E* are in mesh at all times to distribute the reaction torque. Because the cage is part of the driven shaft *F*, rotation of that shaft is assured. A noteworthy feature of the design is that the entire rotating assembly may be removed as a "cartridge," leaving only the housing and the internal fixed gear. By this means it is possible to substitute an assembly giving a different reduction. If a user has a reducer of say 40 to 1 reduction, he may get any other reduction in the range between 20 to 1 and 120 to 1 by obtaining the proper cartridge. He may also make interchanges between this series and the planetary series made in sizes up to 20 to 1. The special series above 120 to 1 reduction use gears *D* and *E* of larger numbers of teeth and thus are not interchangeable with the other series. They are, however, interchangeable within the group.

Other features of these reducers are the use of oversize New Departure ball bearings throughout, gears and shafts of heat-treated alloy steel, over-size slow-speed shaft to take extra chain pull, and triple oil seals. No service factors are required. A reducer of given size is designed to withstand full load operation, or shock loads and also overloads for reasonable periods. Vertical speed reducers have a pump below the lower bearing that carries oil to the top bearing whence it flows by gravity to all gears and the other bearings. Thus, churning and heating of the oil is overcome.

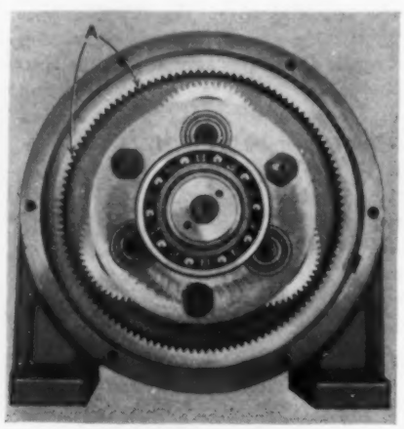
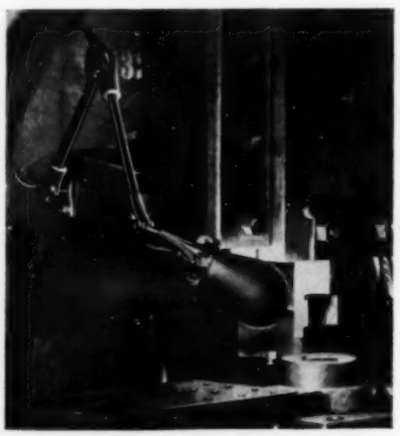


Fig. 1—End shield removed to show high-speed side of "S-B" speed reducer. Note that about 14 teeth of the rack and gyrating gear are always in mesh as shown at *A*

Fostoria Industrial Machine Lamps

The Fostoria Pressed Steel Corp., Fostoria, Ohio, is marketing an industrial machine lamp which can be placed in any position. The bracket used is



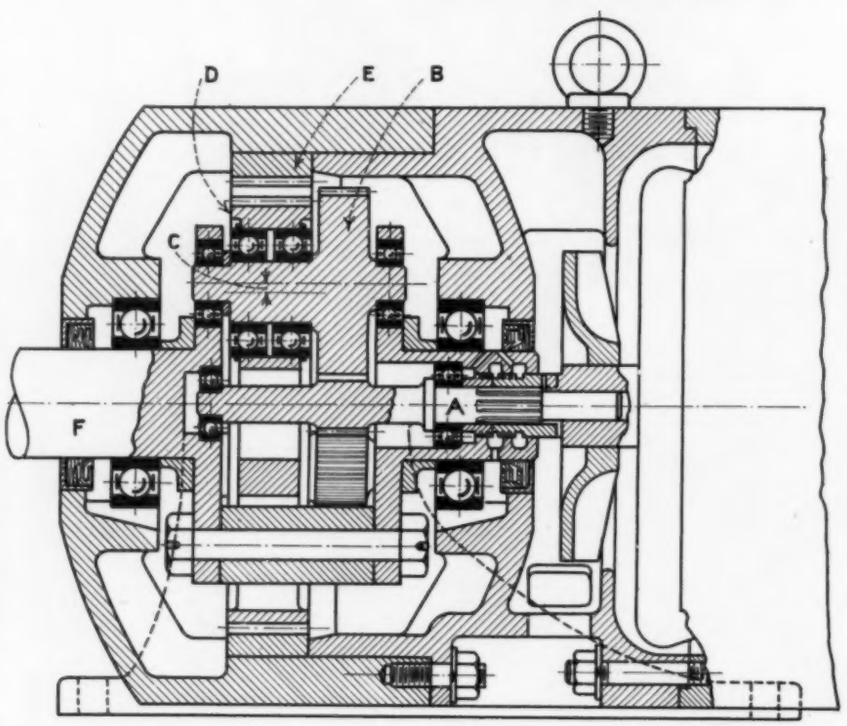


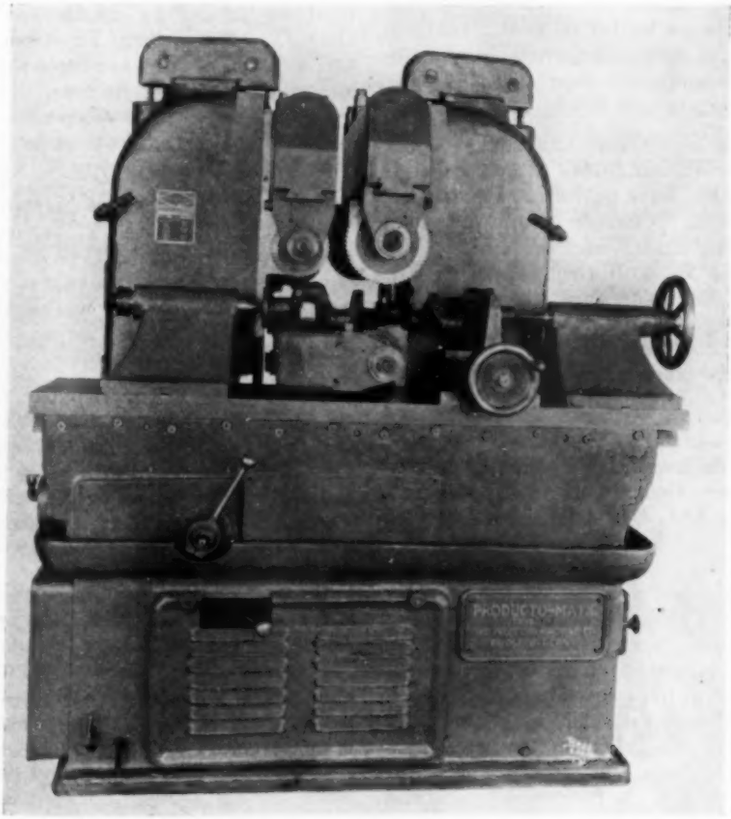
Fig. 2—Longitudinal section showing that the spur gears *C* have eccentric stub shafts to urge the gear *D* through a gyrating path

equipped with three ball and socket joints, and the light cord is contained in the bracket and thus presents no problem. The bracket is made of steel tubing and the light shade is made of aluminum. It is of such size that bulbs may be changed without removal of the shade. Furthermore, the shade is so shaped that maximum protection is afforded to the lamp.

Producto-Matic No. 125 Cam-Type Milling Machine

The Producto Machine Co., Bridgeport, Conn., has developed a No. 125 cam-type milling machine for milling six locating surfaces on an automobile crankshaft preparatory to center turning on production lathes. The crankshaft is mounted between centers and supported by rest blocks at both ends. The machine is designed to mill 100 crankshafts per hour, one operator at each machine. Total weight is 14,500 lb.; floor space is 76x44 in., and the overall height is 90 in.

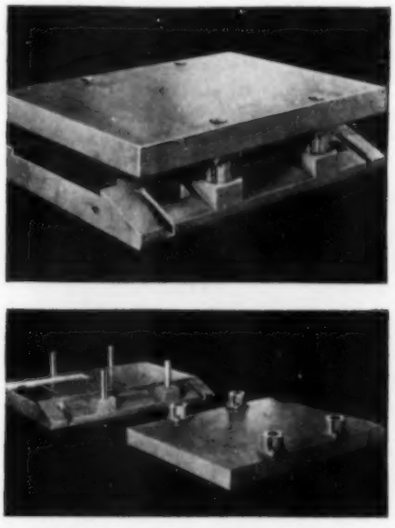
This is a full automatic machine controlled by cams. Movements consist of bringing the cutter spindles in vertically and moving the table horizontally. The two upper cutter spindle bearings move downward to the work and the lower cutter spindle bearing moves upward. These are controlled by drum cams mounted within each of the housings carrying the cutter spindle bearings. Horizontal movement of the table is secured also by a drum cam placed within the bed. The reason for the two movements, that is, the vertical and horizontal movements, is to secure a square cut to to close limits on each of the six locating surfaces.



Danly Welded Steel Die Sets

The Danly Machine Specialties, Inc., 2110 So. 52nd Ave., Chicago, Ill., has been producing for some time special die sets from steel plate by the torch-cut and welding method. The company now anounces that eight types have been selected and a series of standard sizes developed, covering a wide spread of dimensions. These sizes, while carried as standard for immediate fabrication and shipment, do not limit the possibilities of the torch-cut method and therefore complete plate stocks are carried in all thicknesses from 1 to 6½ in. The standard steel die sets include: Round die sets with back posts and in diameters from 6 to 20 in.; round die sets, center post, diameters, 10 to 24 in.; rectangular die sets, back post, 6x12 in. to 20x35 in.; rectangular die sets, diagonal post, 6x8 in. to 20x35 in.; rectangular die sets, center post, 10x12 in. to 28x28 in.; rectangular die sets, center post, 10x20 in. to 40x100 in.; four post die sets, 10x12 in. to 28x28 in., and four post die sets, 10x30 in. to 40x100 in.

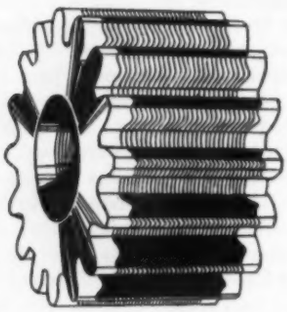
Demountable boss sets are manufactured in which the boss replaces the usual bushing and is regularly held to the shoe or punch holder by four socket-head capscrews. The bosses are readily removable, thereby also releasing the pins and making the complete surface of the shoe or holder, or the die or punch mounted in them, readily available for any type of work. The boss sets are of value when more than one die is mounted in the set, as the ready removal of the bosses and pins makes it easy to change dies. Combination No. 1 is intended for heavy duty work, whereas Combination No. 2 is an alternate. In this type, the guide posts pressed in the die holder are recomended for use where the shut height of the punch press is limited. Demountable boss sets are made in both two- and four-pin series, in all sizes from 10x30 in. to 30x100 in. for the two-pin series, and 10x30 in. to 50x100 in. for the four-pin series.



Assembled and unassembled view of the Danly Demountable Boss Die Set. This is Combination No. 2 designed for use where the shut height of the press is limited and where dies must be changed often

Ganschow Laminated Gear

The Ganschow Gear Co., 1013-15 Washington Blvd., Chicago, Ill., has placed on the market a laminated gear for silent operation. The gears are made up of formed plates which interlock with each other, and which are of "herringbone" construction. Each



gear has a built-in oil reservoir which is filled by removing a plug at the side. Tooth pressure on each revolution is distributed to each plate at different intervals. The cushioning flexibility absorbs vibration on peak loads or reverse rotation and lessens wear on the bearings and mating gear.

Rickert-Shafer Motor-Driven Bench Tapper

A self-contained motor-driven bench tapper in capacities for ⅜ and ½ in. in steel has been developed by the Rickert-Shafer Co., Erie, Pa. The machine is furnished complete with motor, belt, switch and 6 ft. of cord, so that it is simply necessary to plug it into an ordinary light socket. The transmission is by means of rubber V-belts.

Lyon Hydraulic Lift Truck

The Lyon Iron Works, Greene, N. Y., is now building an hydraulic lift truck in three standard capacities; namely 3,500 lb., 5,000 lb., and 6,000 lb. The frame is now made of angle iron instead of channel or flat bar to give greater rigidity and to afford a wider bearing for the skid platform. Timken

roller bearings are used in the front wheels to take side thrust when turning, to make steering easier, and to reduce the wear on the wheels. An air vent of leak-proof construction allows turning over the truck to grease the wheels or for other purposes without losing oil. The truck is painted in green, trimmed with aluminum. Standard lift is 3 in.

• TRADE • PUBLICATIONS

BEARING HOUSING CLOSURES. Data sheets showing detailed dimensions of finished, ready to use appliances for ball and roller bearings are available from the Bearing Appliance Co., Ardmore, Pa. The cast-iron closures include closed covers, open covers with flingers, with felts or for leather oil seals. Fourteen sizes of covers are available and approximately 150 sizes of ball and roller bearings can be fitted.

DRILLING COSTS AND DRILL GRINDING. William Sellers & Co., Philadelphia, Pa., have published two bulletins, the first, "Common Causes of High Drilling Costs," and the second "The Sellers No. 05-B Drill Grinder." The first graphically shows the five reasons for high drilling costs and tells how they may be overcome. The second bulletin announces a fast grinder for small drill maintenance.

END-CUTTING TOOLS. Catalog No. 35, which is being distributed by the Eclipse Counterbore Co., 7410 St. Aubin Ave., Detroit Mich., is furnished in a ring-type cover and loose-leaf sections. Additional data can be inserted as published to make practically a perpetual catalog of the company's products. To date, eight sections have been published on radial drive tools, pin drive tools, multi-diameter cutters, miscellaneous standard tools, adjustable holders, die-sinking cutters, cemented-carbide tools, and special production tool set-ups. A feature of the catalog is the large number of clear illustrations, particularly phantom views of the tools. With each type of tool there is a list of the sizes manufactured, and the prices thereof.

FURNACE LININGS. McLeod & Henry Co., Troy, N. Y., has published a booklet "Furnace Linings and Arches," in which are mentioned "Steel Mixture" cements for forging and welding furnaces, annealing ovens and patch work Other cements, fire brick, and shapes are shown.

JACKS. "Simplex" jacks for a large variety of purposes are shown in a miniature catalog, Form No. 235, issued by the Templeton, Kenly Co., 1020 South Central Ave., Chicago, Ill. Included are planer and machinists jacks, as well as ball-bearing screw jacks.

METAL CUTTING TOOLS. Henry Disston & Sons, Inc., Philadelphia, Pa., is prepared to furnish a loose-leaf binder for its catalog sections measuring 5x8 in. Sections that are available on metal-working tools deal with the selection, care, sizes, recommendations, and specialized information on the following products: metal-cutting bandsaw blades, hacksaw blades, inserted-tooth metal-cutting saws, solid-tooth metal-cutting saws, files, and machine knives.

PIPE-THREADING MACHINE. Bulletin D-84 put out by the Landis Machine Co., Waynesboro, Pa., describes the 1¼ and 2 in. "Landmaco" pipe and nipple threading machine. Salient features of these two machines are discussed, and the specifications for each are listed.

PRESSES. The Niagara Machine & Tool Works, Buffalo, N. Y., has issued a circular describing the Type A5 press recently described in these pages. Specifications, improvements, and features contributory to efficient press operation are graphically portrayed.

S.A.E. STEELS. The Republic Steel Corp., Central Alloy District, Massillon, Ohio, has reprinted the specifications for standard S.A.E. alloy and carbon steels, as revised January, 1935. The publication also lists the products of the Republic company.

TOOLS. The Wesson Co., 1050 Mt. Elliot Ave., Detroit, Mich., has published a loose-leaf catalog containing 25 pages, covering a line of standard and special purpose high-speed steel and cemented-carbide tipped counterbores, inverted spotfacers, multi-dimension cutters, milling cutters and reamers.

THE ROUND TABLE

One-Man Shop

"Where've you been, Al?" asked Ed, as he entered the shop office. "I didn't see you around last week."

"I had a little cold, and I thought I'd take care of it before it got too bad. So I stayed out a few days."

"How did things go without you?" asked Ed.

"Not so well as they should," Al answered. "Why do you ask?"

"Because you've got a one-man shop, just as I thought. You've taken on a few men here and there without providing any additional supervision. I noticed when I was here last week and you were out, that everyone was marking time. You're making a mistake, Al. How many have you on your shop payroll now?"

"Twenty-eight, Ed. And that's not too many for me to look after alone. I've got a pretty good constitution, and I don't miss many days during the year—staying out last week was just a precaution."

"That's what we all think, Al. But it's not fair to yourself nor the people who've put money in this business with you."

"Well, Ed, it wouldn't be any fairer to saddle a little business like this with a lot of assistants and overhead. We're managing to make a little profit now, and we do it by cutting out all extra flourishes."

"I don't mean to go out and hire high salaried assistants. Just set up two or three of your best men as straw bosses. When you're on the job, they could work along as usual, just giving the others some help when they run into a snag. When you're out they would take the responsibility for seeing that there's no let-down."

"Men don't relish taking advice from their fellow workmen, Ed. Many of them would rather take a chance of spoiling a job than asking someone else."

"Not if you let it be understood that the key men have your backing. You could arrange it so when you're here they would give no orders—just instructions when requested. Then the newer men could seek their help."

"It sounds worse and worse, Ed. Frankly I don't feel that I need any help running this little shop. But if I did appoint an assistant I'd give him full authority—none of this half-way stuff where neither he nor the men know where they stand."

Is Al wise in continuing his business on a one-man basis? Is it practical to give a man limited advisory authority and still hold him responsible for results?

Discussion

Shop Instructions

A new man at an old job usually saves some time by following an instruction sheet, and for the man who does only a certain job infrequently it serves a good purpose by checking his memory.

Instruction sheets indicate what has been found to be the most satisfactory and practical methods with the available equipment and should always be understood to mean just that.

While suggestions for new methods should always be encouraged, no departure from the instruction sheets should be made without a consultation and an agreement with the foreman in charge.

—JOHN MARK MAY.

We have been using instruction sheets in our apprentice training school for a number of years. The sheets are made out for all our line of jobs, and their use has enabled us to set a standard or average time for each job. As each boy doing the same job follows the same method, we have a fairly good check on each boy's ability and earnestness. The boys, however, are encouraged to make suggestions as to better methods of doing the job, and if a different method is adopted, then both the instruction sheet and the standard time are changed.

The idea that the man doing the job will know how to do it should not hold back Al's plan, for if left to use their own judgment, a group of men each doing the same job will do it in about as many ways as there are men in the group, and some will do the job in less time than others, due mostly to using better methods.

—THOMAS M. GARRY,
Instructor, Apprentice School, Yale & Towne Mfg. Company.

Tooling Up

So long as Al can produce his parts with the necessary precision and at a cost yielding a satisfactory profit, the matter of more fixtures becomes one of choice and not of compulsion.

If volume of business in one or more sizes increases so as to cause a manufacturing bottle neck, Al may have to make a choice between extra hour's usage of existing facilities, method changes, outside purchased machining, or detail redesign to facilitate machining. Which of these choices to make

will depend upon whether the bottle neck is permanent or temporary.

Whatever tools Al builds must be absorbed over some assigned quantity of articles, and so long as his costs are satisfactory there is little point in changing methods unless forced by external trends, that is in accurate anticipation of circumstances demanding definite cost reduction either to meet competition or to permit broadening the market. Further, his cash reserve is limited and unless the revised methods utilizing new fixtures earn a profit very rapidly, the financial health of the concern may be disturbed.

Al is evidently preserving his cash reserve—perhaps wisely at the moment, but he must be ready to spend money to save money when the time to do so approaches.

—R. V. Hutchinson.

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● *At Right:* Natco multiple spindle drill, Oilgear Fluid Power Feed equipped.

● *Above:* A new Oilgear Fluid Power Feed. Note: Flanged mounting, as integral machine part . . . Inside pump, eliminating hazard and bettering appearance . . . Self-contained; auxiliary valves, tubing, etc. are integral with pump . . . Many other exclusive features.

WITHOUT greatly altering existing machines, new speed and smoothness are achieved at new low cost by Oilgear's record-breaking new Fluid Power Feeds. Every builder, every buyer, should have the facts; get Oilgear's book. The OILGEAR Company, 1309 W. Bruce Street, Milwaukee, Wis.

OILGEAR FLUID POWER FEEDS

(B-1304)

Hiring Older Men

As men are usually at their best physically when they are about 25 years old, and at their best mentally when about 50 years old, the comparative merits of men of those two ages necessarily depends upon their fitness for the particular kind of work required of them.

Another thing to be considered is that there are great differences in men of the same age. It therefore appears that no general rule can be made to cover all cases. The man who requires the work done, and has to pay for it, will naturally be best qualified to judge what kind of man will render the best service. Hence the small shop employer, who pays out his own money and is continually in close personal contact with his employees, is more likely to get better results than is the paid representative of an employer of labor in a large shop.

For some kinds of work, a man 75 years old may be better qualified than a man of 25 or 50 years. If there is any rule that can be applied more generally to merit, it is that the quality and quantity of output delivered by an individual depends more upon what he is able to do in a given time than upon his age.

—L. Brown,
Montreal, Canada.

Many a man who knew it all when he was 25 has really learned enough when he reaches 45 to take a sober inventory of what he does know, and is in a good position to learn as he has never learned before.

While the younger man will often make a better showing as to quantity than the older man, one will hesitate to give him a particular job. It will be given to old Bill Jones because the boss has seen him conquer too many ticklish jobs to have any doubt of the result.

There is good reason to believe that from the time of apprenticeship until he is 40, the average man's mental and physical powers are on the increase. From that time on his physical powers will probably trend slightly downward, but he will certainly continue to advance mentally. It is doubtful if any man reaches his intellectual prime before he is 50.

Setting a low-age limit on employees in general from a cold business standpoint is simply trading brains for brawn. The real answer to the question is that a man should be judged by his actual demonstrated ability, rather than by the number of birthdays he may have celebrated.

—John E. Hyler.

Who Buys the Micrometers?

It seems to me that the shop men should provide their own micrometers. Of course, this does not apply to micrometers of large size or inside micrometers, which should be provided by the management.

There is no good reason why the men should not take an interest in doing good work and have their micrometers checked periodically, say once a week. If the men demur, they can be penalized either by piecework reductions or in the same manner as tardiness is handled. If there is sloppy work going on, there is something wrong with either the inspection staff or the supervision. In this era of superfine workmanship there is really no good reason for inaccurate work in the machine shop.

—Joseph Murphy,
Mitchell Machine Company.

Finish Cuts Only

Almost any new machine tool can be used for both roughing and finishing, although the accuracy obtainable depends largely upon the ruggedness and soundness of its design. On the other hand, if the tool were originally built for precision work, its possibilities for successful performance on rough, heavy work would be rather remote.

If a machine tool is used for both roughing and finishing, the strains imposed by roughing will finally set a limit to the degree of accuracy obtainable. But if a machine tool is used for finishing only, its potential life as regards accuracy will be enhanced. From an economic standpoint, the only way that an investment in separate tools for roughing and finishing can be made to return dividends is to determine absolutely if their efficiency is in keeping with the accepted rate of depreciation.

—Harold L. Wynn,
Executive Engineer,
Pacific Electric Mfg. Corp.

Codified Skill

At present there is a considerable surplus of all classes of labor, and modern organization has reduced the advantages that skilled men once held. A rigid fixing of wages in the same way as minimum wages are fixed would not be satisfactory. Men occupying highly skilled or responsible positions are usually chosen with care by their employers, who pay them a fair wage.

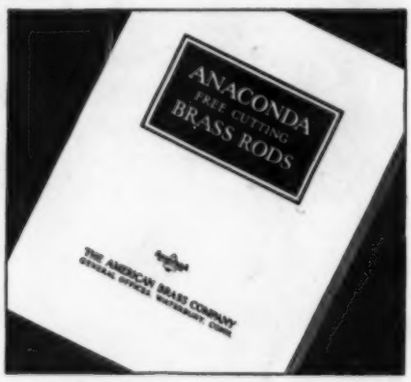
While it is only right that there should be a minimum wage for unskilled labor, a large number of skilled men are employed whose skill is not sufficient to protect them from the intense competition in the labor market. An unscrupulous employer can, therefore, obtain this class of labor at considerably below fair market value, which gives him a great advantage when competing with other employers who remunerate their employees fairly. Therefore, in the interest of both employer and employee, a uniform wage rate throughout industry would be an advantage.

To regulate rigidly all wages would be impossible, but a minimum wage for each grade of labor to prevent their exploitation by unscrupulous employers would be an advantage.

—W. E. Warner,
Kent, England.

Can you save money by spending *more* for stock?

This free booklet tells how Brass Rod cuts costs of screw machine products . . .



THIS complete new booklet has been called a "liberal education" by experienced production men. Going thoroughly into details, it treats of tool life, tool breakage, power consumption and the many other factors that help determine the ultimate cost of screw machine parts.

Special cold drawn and extruded shapes . . . that save their metal cost many times over by eliminating expensive milling and other machining operations . . . are reviewed in detail.

In addition to Brass, the characteristics of Anaconda Free Cutting Phosphor Bronze, leaded Nickel Silver, Everdur, and other Anaconda Free Cutting Alloys are also described.

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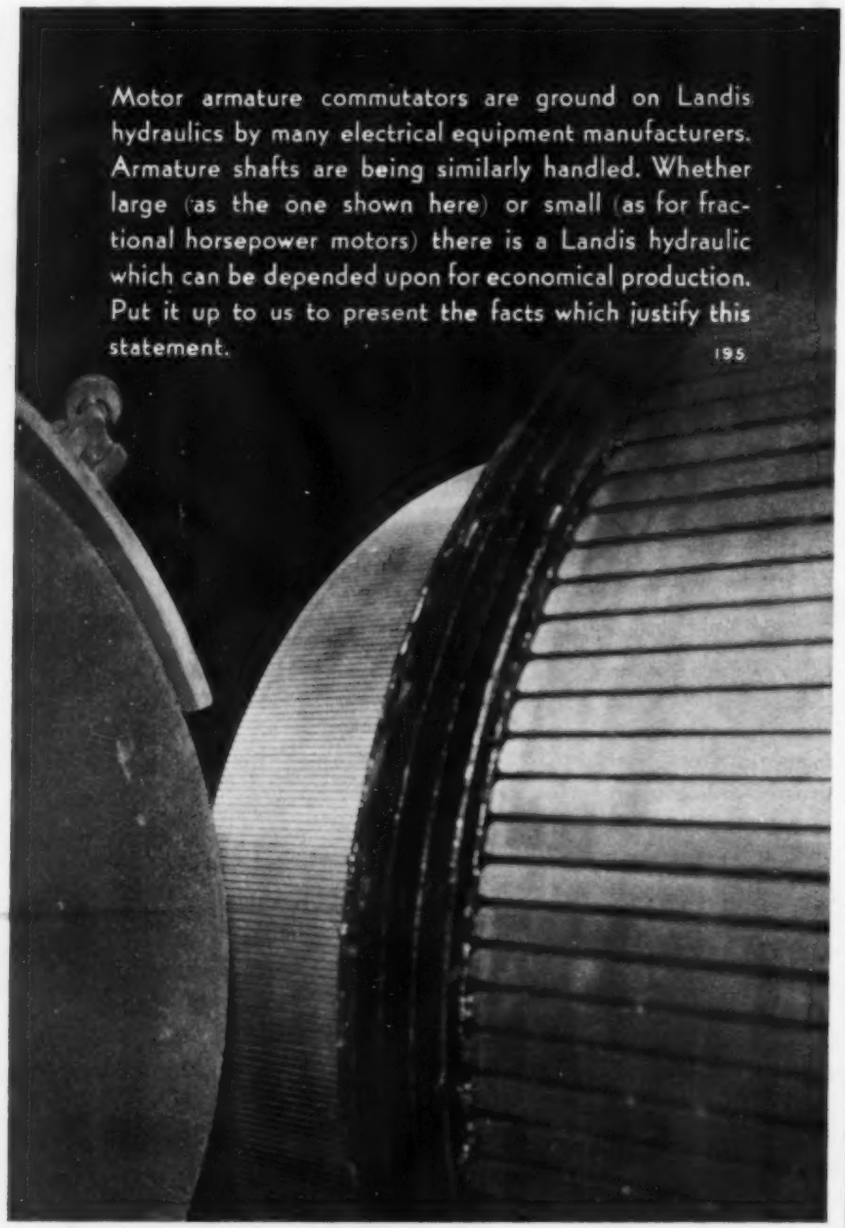
SEEN AND HEARD

JOHN R. GODFREY

Safety in Locomotive Axles

I have pointed out the advantages of grinding locomotive axles and crankpins on several occasions. These advantages had to do for the most part with increased life because of better bearing surfaces. Wheel fits are also said to be better and to hold with less pressure. Recently, however, I've seen a case of broken axle in which the crack started from a tool mark left in turning. Grinding would have removed the metal beyond the bottom of the tool mark. Rolling would simply force down the high ridges but would not remove the low valleys of the tool marks. Safety may prove to be a more effective argument for the adoption of grinding than service. The care with which makers of springs for "knee action" wheels remove the slightest mark from the rod indicates the present trend.


Motor armature commutators are ground on Landis hydraulics by many electrical equipment manufacturers. Armature shafts are being similarly handled. Whether large (as the one shown here) or small (as for fractional horsepower motors) there is a Landis hydraulic which can be depended upon for economical production. Put it up to us to present the facts which justify this statement.
195

LANDIS TOOL CO.
WAYNESBORO, PA.

"No Tolerance Permitted"

There is still a lot of missionary work to be done before we even approach standardized methods. This refers more to an understanding of what the other fellow means than to actual methods of doing the work itself. As an example a recent publication for railway shop men has the terms "allowance" and "tolerance" badly mixed all through the book.

To add to the confusion a railway drawing for locomotive side rods bears the warning, "No tolerance permitted in length of rods." The chances are that variations of from a sixty-fourth to a sixteenth are not uncommon. This same drawing gives no tolerances on a single dimension and no reference as to permissible variations. I'm not advocating close tolerances where they are not necessary, but every mechanic should know how close it is necessary to work.

Short Center Belt Drives

We all remember the old, long center belts that had sag enough on the upper side to hug the pulleys way beyond the 180 deg. mark. The weight of the belt gave the tension without straining the belt clamp in lacing. According to a good authority it takes a 100-lb. pull to get an initial sag of only 1 in. on a 25-ft. belt center while on a 2½-ft. center you can get only a ½-in. sag with but a 7-lb. pull. The long centers have many advantages, but only from the driving angle. They take up too much room in the modern shop. That's why short center drives are being used more and more in spite of their disadvantages. The pivoted motor base that lets the weight of the motor provide the tension is replacing the idler pulley.

Cast Crankshafts

Cast crankshafts, using some of the new alloys, are making headway. Most of us probably feel a bit skeptical even though we realize the advances that have been made both in alloys and in foundry practice. But the fact that thousands of cast crankshafts are in use, some in diesel engines and others in severe service, stares us in the face. Entirely aside from cost we have the advantage of being able to cast the counterweights integral with the shaft, which effectually prevents their coming loose. Designers as well as production men will be affected by these advances in making sound, strong castings for use where we formerly considered forgings indispensable. They should bring reduced costs.